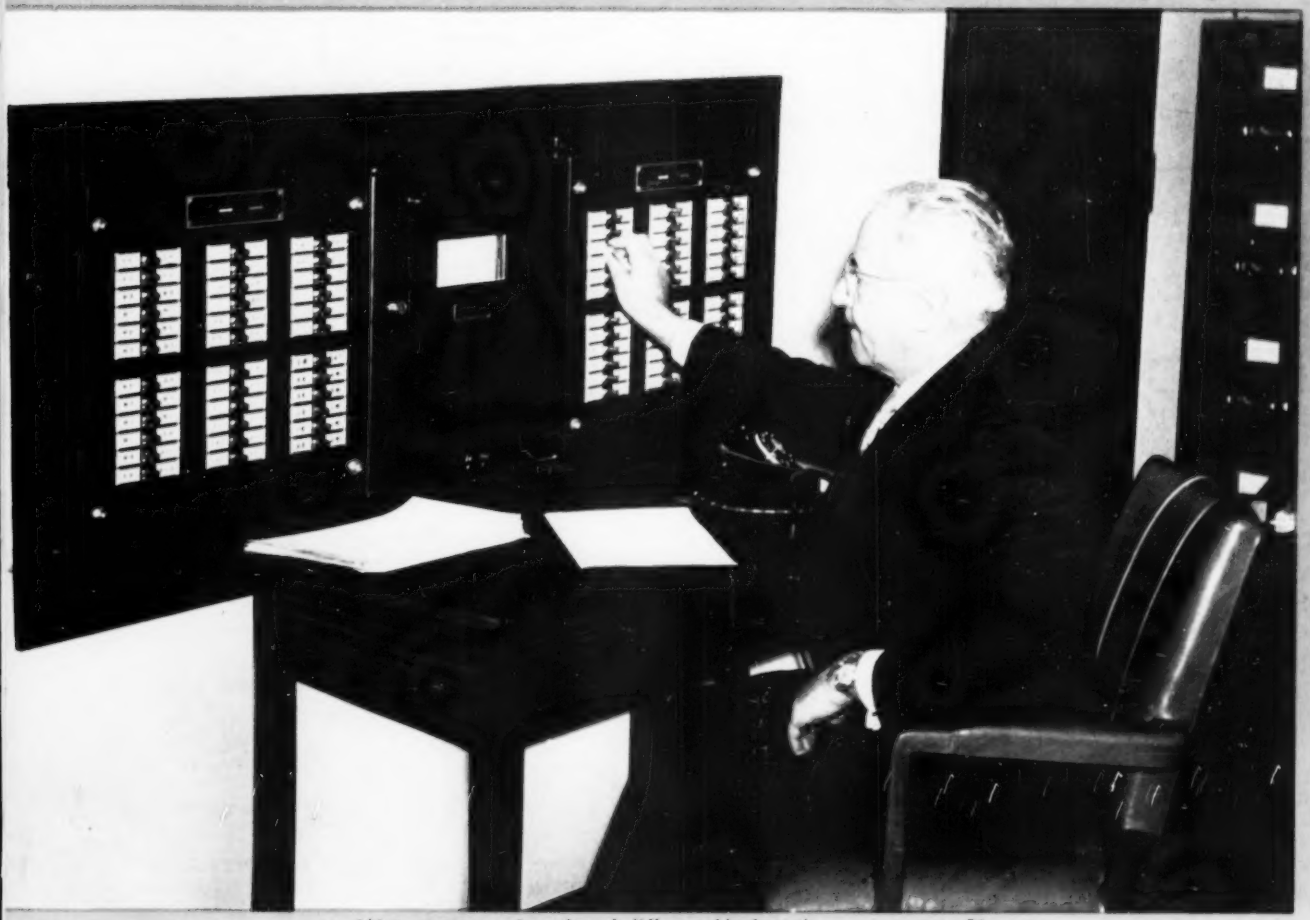
Heating Piping & Air Conditioning

INDUSTRIAL
COMMERCIAL

DECEMBER ★ 1953

INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 111—Journal Section of The American Society of Heating and Ventilating Engineers



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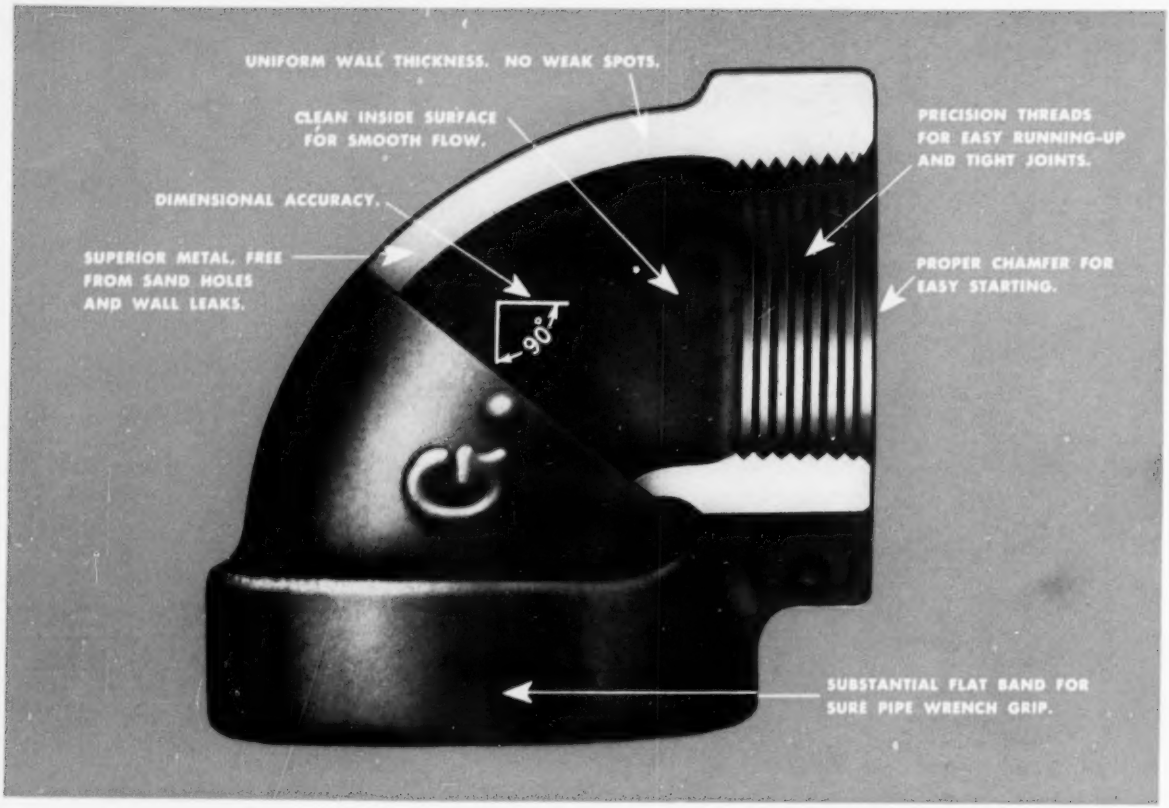
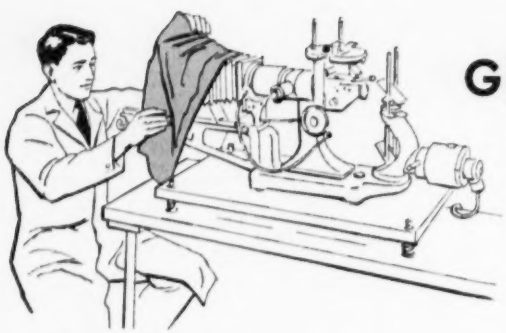

UNIFORM WALL THICKNESS. NO WEAK SPOTS.
CLEAN INSIDE SURFACE FOR SMOOTH FLOW.
PRECISION THREADS FOR EASY RUNNING-UP AND TIGHT JOINTS.
DIMENSIONAL ACCURACY.
SUPERIOR METAL, FREE FROM SAND HOLES AND WALL LEAKS.
90°
PROPER CHAMFER FOR EASY STARTING.
SUBSTANTIAL FLAT BAND FOR SURE PIPE WRENCH GRIP.

Rigid Inspection

From foundry to finished fitting—modern inspection methods insure the quality of

GRINNELL PIPE FITTINGS



The "Photomicrograph"
By means of photomicrographs, the metal structure of castings is thoroughly checked for full information on production quality.

For instance, for malleable fittings, laboratory technicians make an hourly chemical analysis of foundry metal to insure uniform, high quality. Daily tests by photomicrograph reveal metallurgical structures. Sample bars from each melt are subjected to tensile strength tests . . .

Fittings must pass a 100% inspection both before and after machining. Quality control includes alignment tests, high pressure hydrostatic tests, and comparator checks on the accuracy of threads and chamfer.

That's why, when you specify Grinnell cast iron and malleable iron pipe fittings, you are sure of—

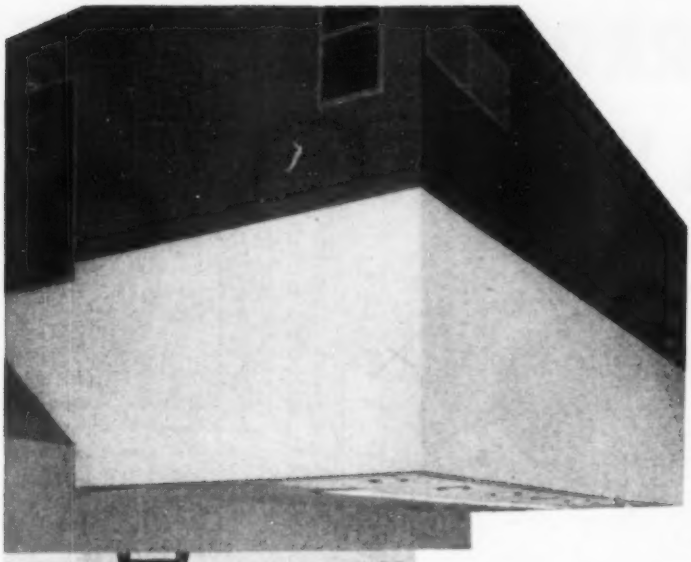
- High quality metal
- Dimensional accuracy
- Clean inside surface for smooth flow
- Proper chamfer for easy starting and protection of first thread
- Precision threads for easy running-up and tight joints

To make fittings the safest, strongest link in your piping system . . . choose from the wide Grinnell line. Available from your local Grinnell Distributor or a Grinnell Warehouse.

GRINNELL
WHENEVER PIPING IS INVOLVED

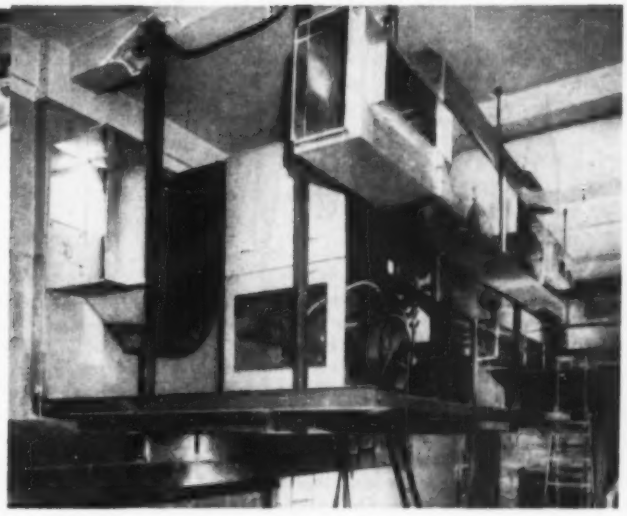
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems



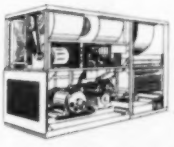
New York Pharmacy Saves Floor Space

BY SUSPENDING AIR CONDITIONING SYSTEM FROM CEILING!



ABOVE: *Completed installation blends beautifully with all over architectural plan of Lewis Pharmacy.*

RIGHT: *Picture of installation in progress shows RK-15 unit suspended from ceiling, to be housed in steel framework.*



When Lewis Pharmacy, New York soda fountain-luncheonette, decided to install an air conditioning system, their major problem was lack of floor space. The problem was solved by the installation of a usAIRco RK-15 (Refrigerated Kooler-aire, 15 H.P.). Instead of the conventional floor type installation, this central station package unit was suspended from the ceiling in a steel-framed enclosure above and behind the counter.

The enclosure is oversized to provide room for service and to accommodate an exhaust blower to remove cooking odors from below. The installation blends attractively with the interior decorating plan of the pharmacy. Imperial Equipment Corporation engineered and installed the system for the Lewis Pharmacy.

The usAIRco RK-15 combines all the elements of space-consuming built-up systems into one neat package. Air conditioner, compressor and evaporative condenser are combined in this single operating unit. Delivered ready for immediate installation, only 3 connections are necessary: to ducts, water supply and drain, and power supply.

United States Air Conditioning Corporation manufactures RK in 10 various sizes, from 3 to 50 H.P. capacity, to fit any air conditioning requirement.

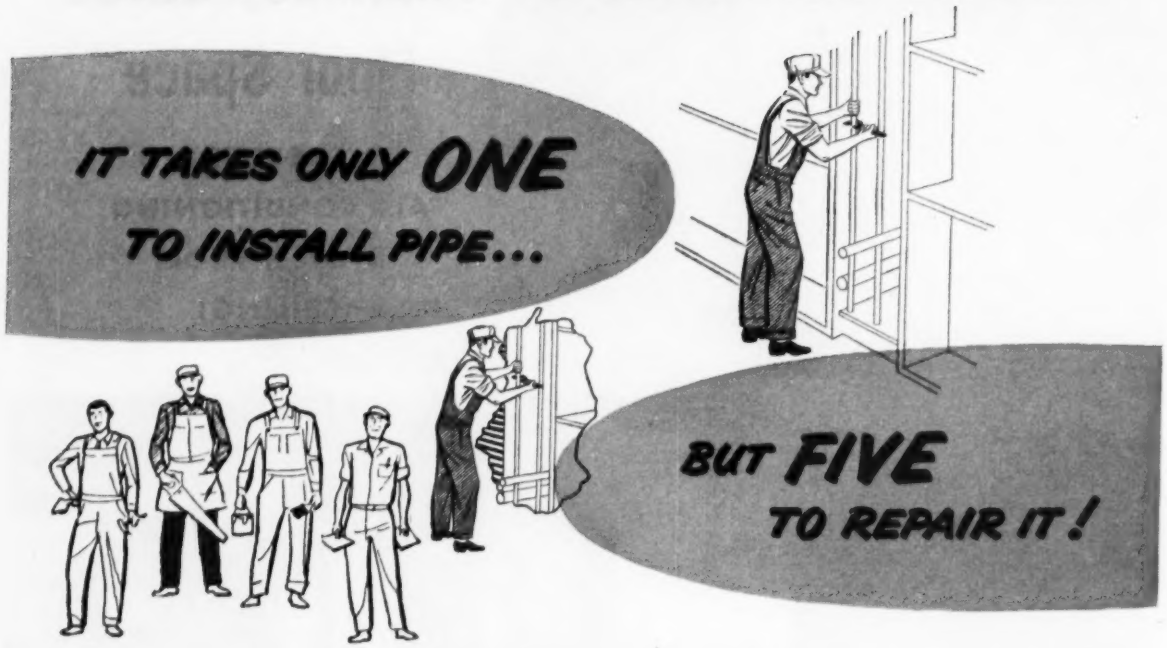
For Descriptive Literature on RKs Write Dept. HP 123

UNITED STATES AIR CONDITIONING CORPORATION

MINNEAPOLIS 14, MINNESOTA

usAIRco
EVERYTHING IN AIR CONDITIONING

Here's why CORROSION COSTS YOU MORE than WROUGHT IRON



One of the most convincing demonstrations of the economy of using *durable* material is a pipe repair job where low-first-cost material has failed—and is being replaced.

The original installation had been quickly made by plumbers. But the replacement calls for hours of work by as many as five crafts: plumber, mason, plasterer, carpenter, painter. Often, maintenance is billed at overtime rates. And this is only part of the cost story. Production slow-down, disrupted routine may amount to far more than the maintenance charges.

Fortunately there's an answer to pipe durability in corrosive services—Byers Wrought Iron pipe. In literally thousands of applications where corrosion is a threat, the use of this material has proved the soundest kind of economy move.

The next time you specify or approve pipe, you'll find it profitable to investigate the durability records of wrought iron.

Our bulletin, "The ABC's of Wrought Iron," gives the what, why and where of this material. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston. San Francisco. Export Division: New York, New York.

Remember—
the pipe that lasts
the longest
costs the least!

FOR PRODUCTION CONTINUITY LOWER MAINTENANCE— Insist on Byers WROUGHT IRON PIPE

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 25 No. 12

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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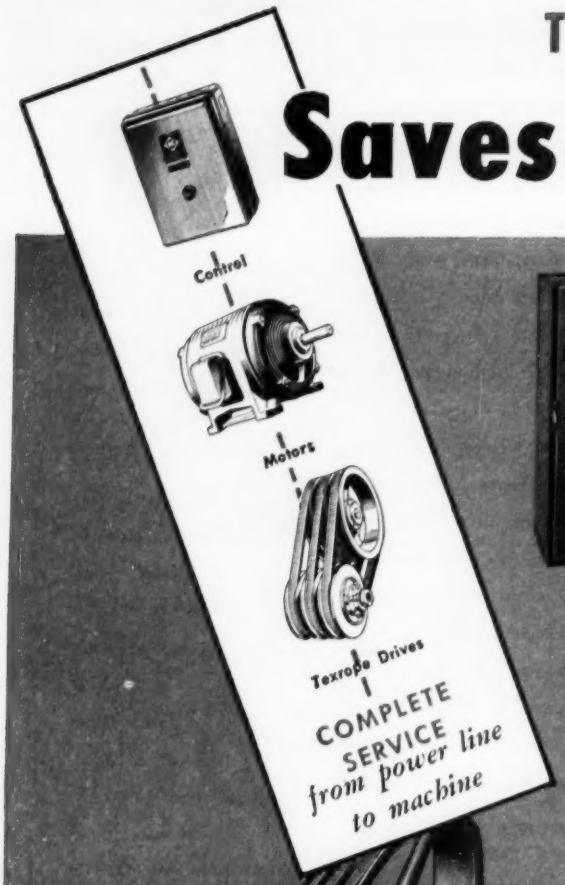
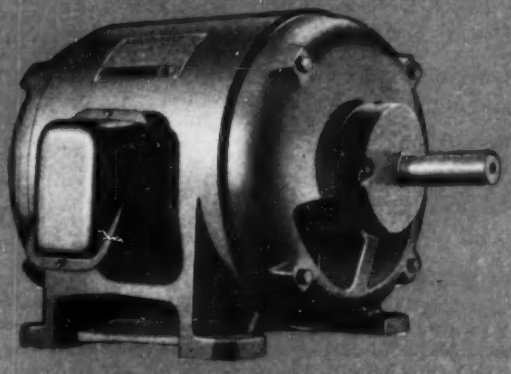
THE CONTROL-MOTOR-DRIVE

Saves Engineering



Motor Control

Allis-Chalmers motor control is available for most air conditioning applications from Size 0 up. Allis-Chalmers builds many types of variable speed control for ac and dc wound rotor motors. These are applied to pumps, fans and other machines requiring speed control.



Motors

Allis-Chalmers general purpose and special motors meet almost any air conditioning need from ½ hp up. Types include squirrel cage, wound rotor and dc for single or multi-speed operation. These motors are available with a full range of torque characteristics and a wide choice of enclosures and mounting methods. Many air conditioning contractors are now recommending Allis-Chalmers fin-type totally-enclosed, fan-cooled motors because of their extremely low maintenance costs. Protected from dirt and moisture, these motors last longer and require less service than standard open type.

Texrope Drives

Texrope V-belt drives, the original multiple V-belt drive, are available in complete range of sizes and types, both fixed and variable speed. More and more air conditioning installations are being equipped with *Vari-Pitch* drives for easier system balancing, quicker speed changes for seasonal adjustments and more versatile performance of all types of equipment. The small extra cost is more than paid back by reduced adjustment and maintenance time. With either Stationary Control or Motion Control *Vari-Pitch* sheaves, speeds can be accurately adjusted, quickly and easily, over a wide range.

ALLIS-

COMBINATION THAT . . .

and Installation Time

By specifying the Allis-Chalmers motor-drive-control package, you cut time usually required to engineer the job . . . thus making the job easier and more profitable for you. Here's how:

1

An experienced Allis-Chalmers distributor or district representative is ready to help you engineer the complete drive.

2

All drive components arrive on the job together, ready to be installed.

3

Backed by "unit responsibility" — provided only by Allis-Chalmers—if service is needed.

Nation-wide Stocks — An adequate stock of drive equipment commonly used in air conditioning installations is maintained by Allis-Chalmers district offices and Authorized Distributors. You get fast delivery when you need it. In addition, an efficient warehouse inventory system locates hard-to-get items within hours after you call.

Certified Service — Nearly every industrial area in the country has one or more Allis-Chalmers Certified Service Shops . . . independent service shops which meet Allis-Chalmers high standards for modern equipment, efficient methods, and business integrity. These shops assure your customers factory-approved parts and equipment.

For lower engineering and installation costs . . . for one reliable guarantee of satisfaction on the complete drive unit . . . for quick delivery and top-notch service . . . make your next drive Allis-Chalmers.

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

A-4205

Send for Free Engineering Literature

Motors

- ☐ Handy Guide to Motor Selection 51B6052
- ☐ Squirrel-Cage Motors 51B6210

Control

- ☐ Handy Guide to Starters 14B7733
- ☐ Reduced-voltage Starters 14B7215

***Texrope* Drives**

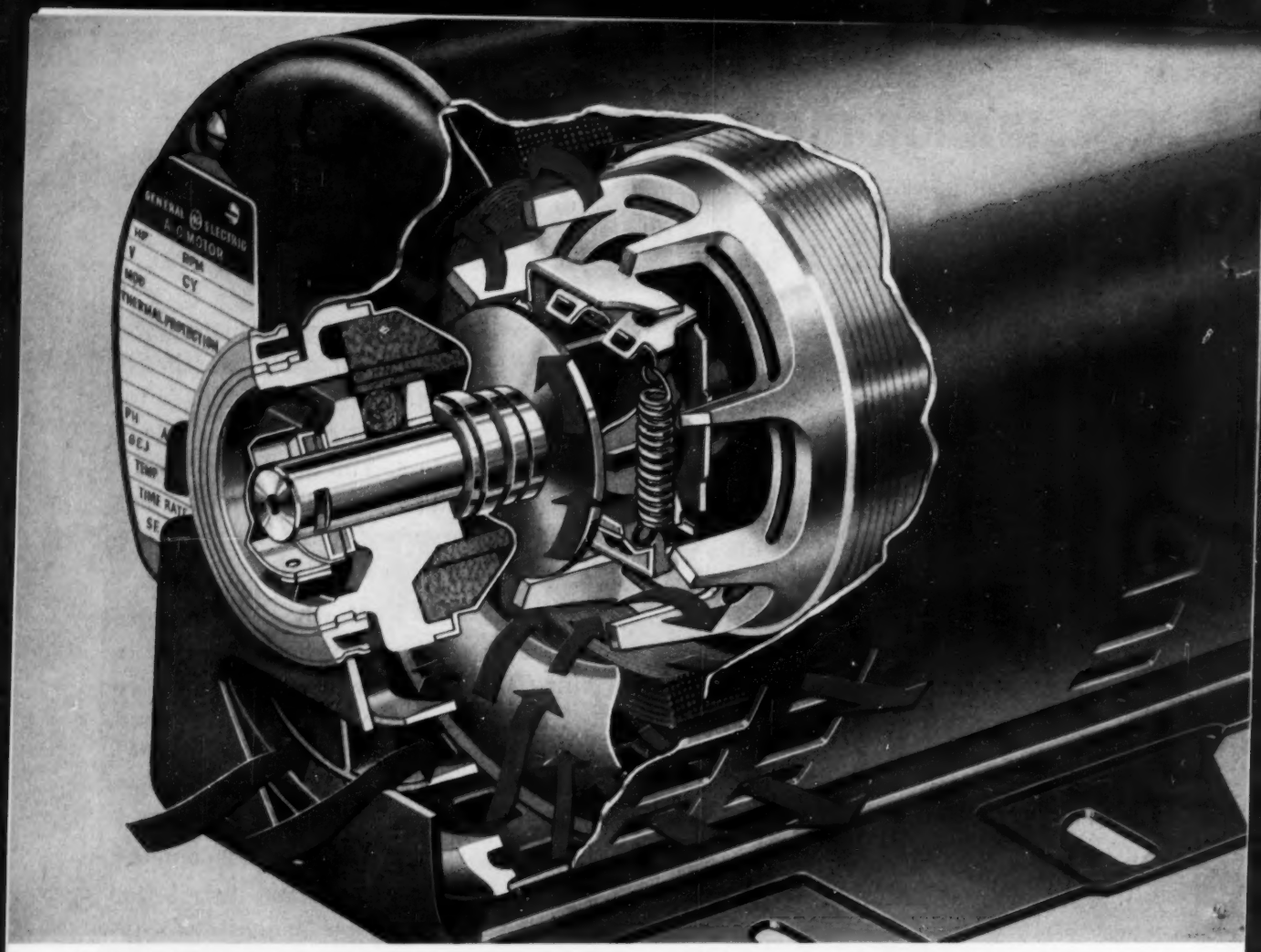
- ☐ Handy Guide to *Texrope* Drives 20B6051
- ☐ *Vari-Pitch* Drive Engineering Data 20B7499

Allis-Chalmers, Milwaukee 1, Wisconsin

Name..... Address..... Position.....

CHALMERS

A-C ALLIS-CHALMERS



VENTILATION SYSTEM on new open drip-proof fhp motor pulls air in through end shield and first row of shell louvers. Baffle and fan uniformly direct the air over the windings and end rings where it absorbs heat . . . and exhausts it through the inside row of louvers. On the shaft end of the motor, air enters through the end-shield ventilating openings . . . absorbs the heat and exhausts it through the stator ventilating louvers. This controlled air flow permits more compact motor design.

New design, better ventilation

. . . reduce your assembly and shipping costs

From shipping, through storage and assembly, smaller sizes in the new G-E fhp motor line . . . as much as 40% smaller . . . bring you much easier handling and far greater economies. Applying an entirely new concept of electrical-mechanical design, the new G-E fhp motor line features an improved ventilating system that effectively dissipates heat from a reduced surface area.

In both open dripproof and totally enclosed fan-cooled motors, the ventilating system is co-ordinated as part of the basic electrical-mechanical design. This gives maximum power in minimum space.

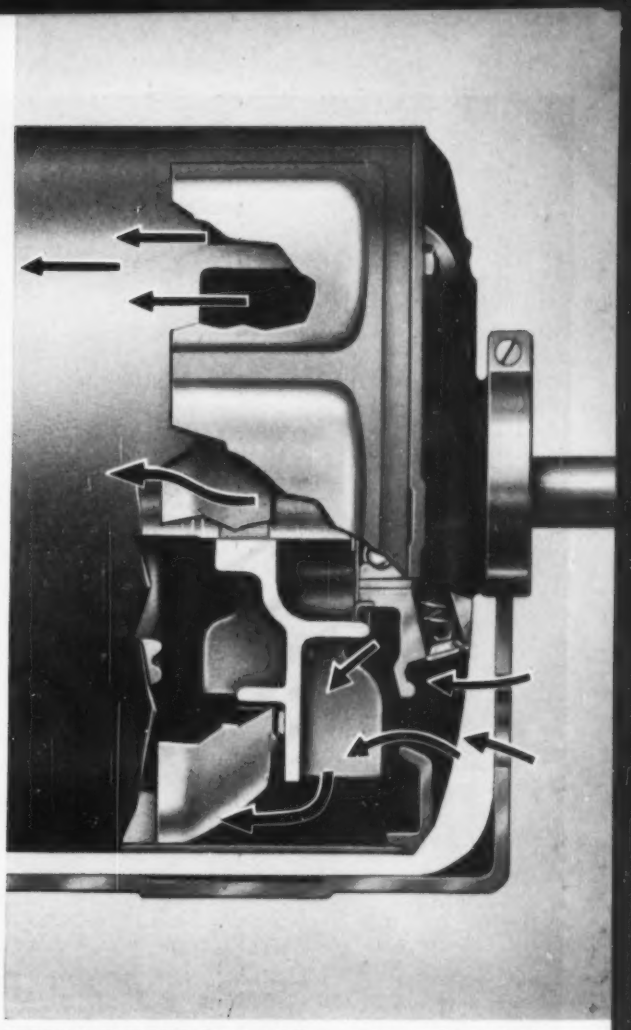
When you need motors, remember too that new G-E fractional-horsepower motors give you full NEMA performance, up to 50% less weight, all-angle operation, extra long life . . . the features you need for efficient, versatile motorization.

Find out more about the all-new G-E fhp line. Contact your nearest G-E Apparatus Sales Office, Authorized G-E Distributor, or write Section 702-4 for bulletin GEA-5567, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

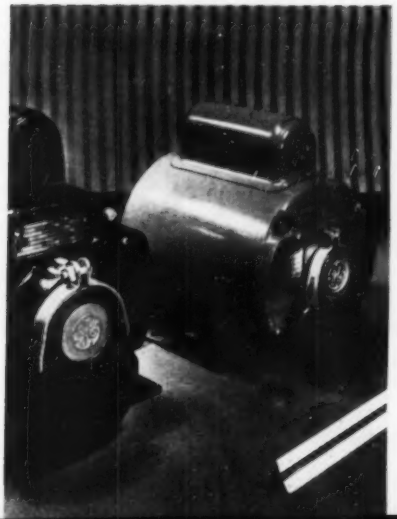
ELECTRICAL-MECHANICAL DESIGN applies new materials and techniques, providing full-rated power in smaller motor size. (1) Baffle channels air, helps prevent hot pockets. (2) Fan blades, cast integrally with the aluminum rotor windings, conduct heat from rotor for cooling.



TOTALLY ENCLOSED fan-cooled fhp motors now feature both external and internal fans within stator shell. Air enters through open end shield, passes by dust-tight motor cover, and out special louvers which guide cooling blast along stator shell.

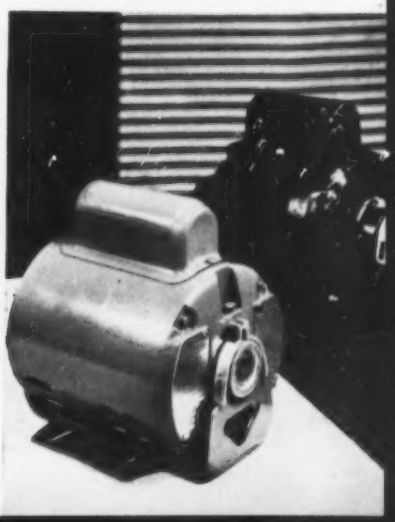
make G-E fhp motors smaller

SMALLER

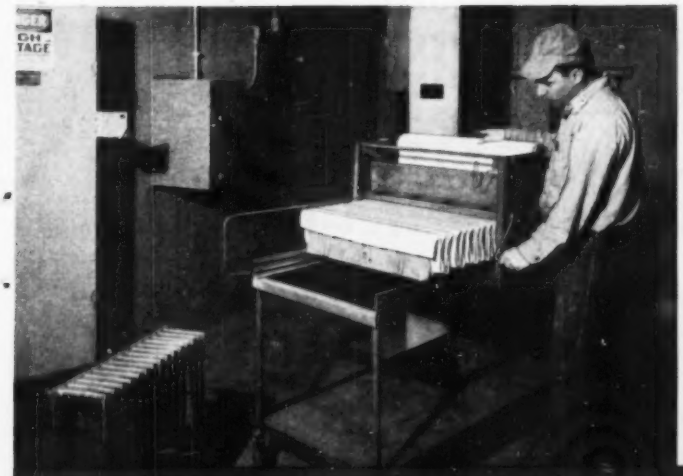


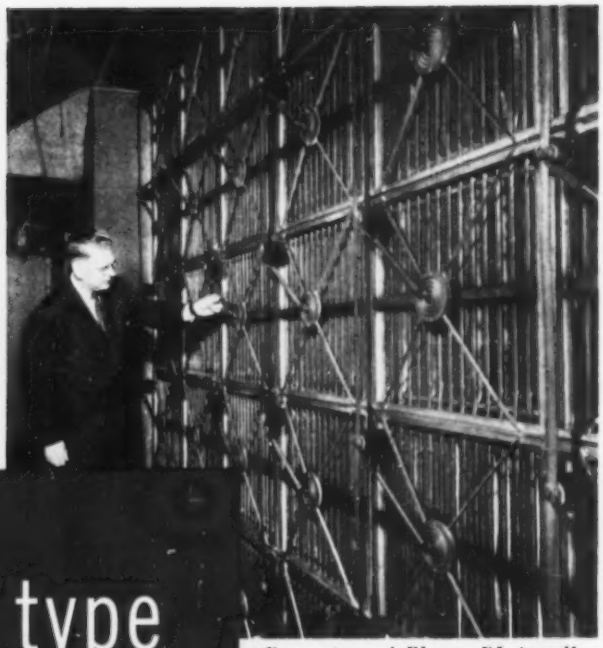
LIGHTER

BETTER LOOKING



An Electro-PL installation of 25,000 cfm cleaning the air for a large Midwest library to protect rare books and manuscripts. The operator is removing a collector element for servicing.





Rear view of Electro-PL installation showing electrical connections to individual units.

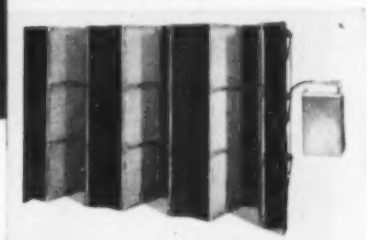
...the only dry type electronic air filter

ELECTRO-PL gives twice the filtering efficiency of ordinary dry filters . . . at low initial cost.

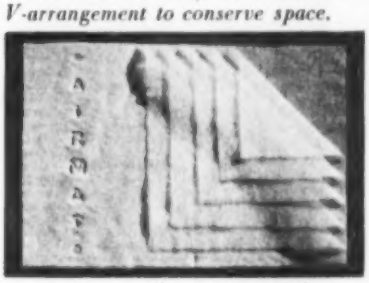
The Electro-PL is an exclusive development of AAF engineering research.

The many advantages and low initial cost of the Electro-PL account for its broad applications in both industry and commerce. Engineered for simple, economical maintenance, it requires no water and sewer connections . . . needs no oil to retain precipitated dust. The Electro-PL is easy to install, safe to operate, and becomes essentially a new filter each time the Airmat media is renewed. Another important "safety" plus is that the Electro-PL maintains efficient air filtration even when there are power failures.

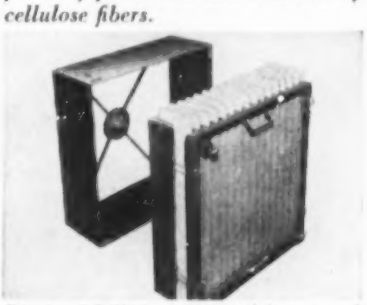
For information on Electro-PL call your local AAF representative or write direct to us for our Engineering Bulletin No. 257.



The Electro-PL may be installed in V-arrangement to conserve space.



6 ply Airmat filtering material composed of porous tissue-thin sheets of cellulose fibers.

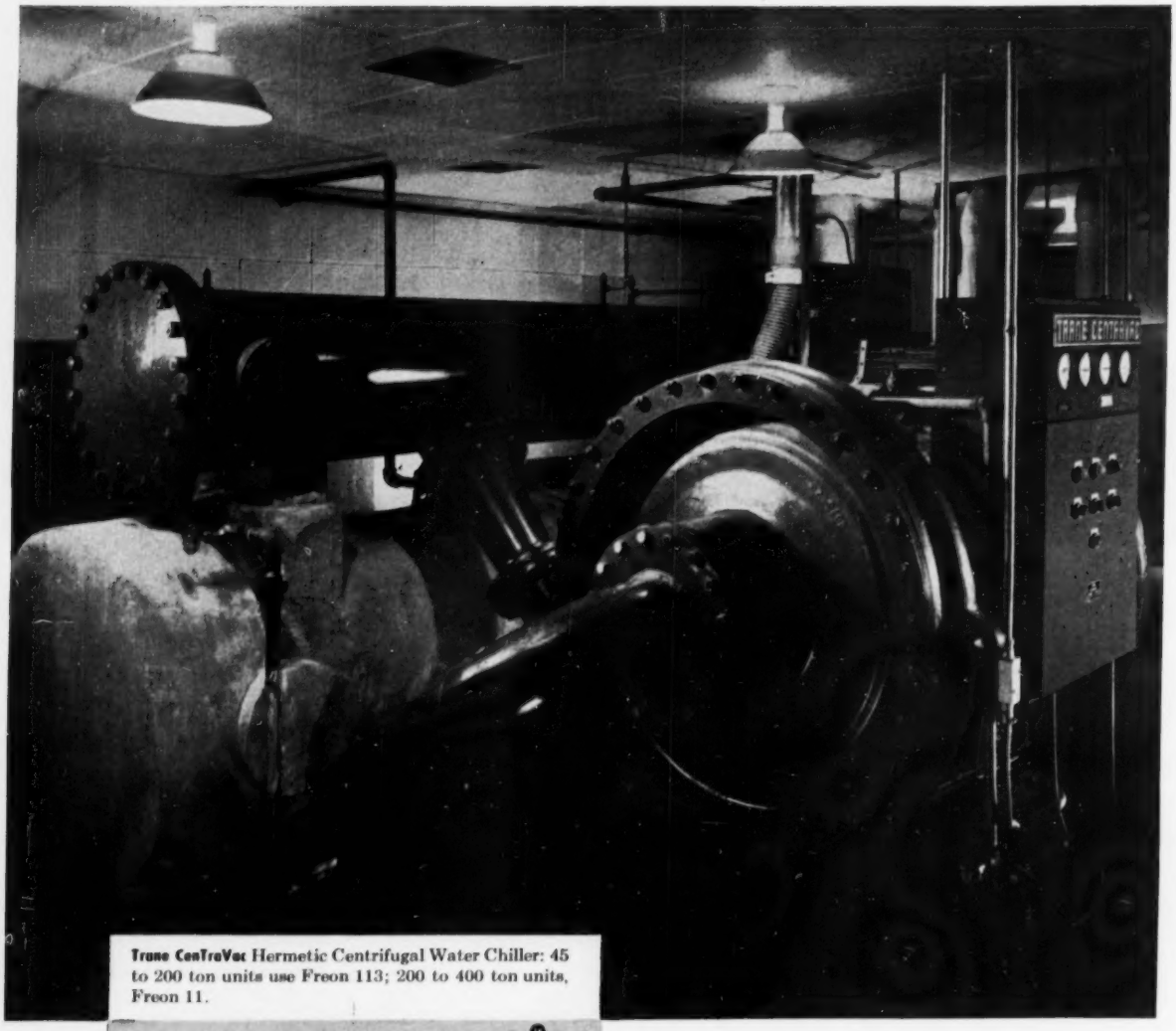


Electro-PL Unit consists of frame and collector element.

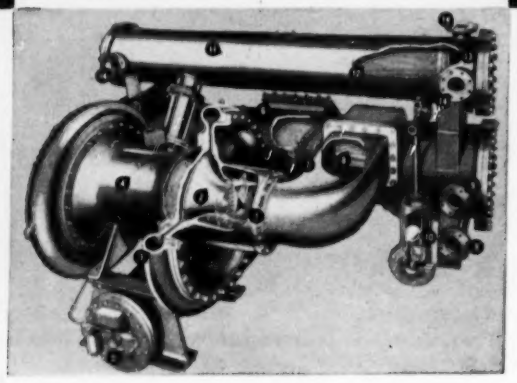
American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

Trane CenTraVac centrifugal water stable operation down to



Trane CenTraVac Hermetic Centrifugal Water Chiller: 45 to 200 ton units use Freon 113; 200 to 400 ton units, Freon 11.



1) Vane control—permits operation down to 10% of rated capacity. 2) Impeller—assures high efficiency. 3) Volute housing—smooth gas flow. 4) Motor—hermetically sealed, eliminates shaft seals and gear boxes, gives quieter operation. 5) Lubrication system—fully protected from failure. 6) Evaporator—semi-flooded type. 7) Tube bundle. 8) Eliminator—prevents liquid carry-over. 9) Evaporator water connections—2, 3 or 4 pass, give flexibility for all water flow conditions. 10) Float valve—refrigerant flow control. 11) Condenser. 12) Tube bundle. 13) Water boxes—marine type. 14) Water connections.

chiller—assures 10% of capacity!

Now, with the CenTraVac, you can design a system that automatically adjusts to varying cooling requirements with power savings in almost direct proportion to load variations.

In any air conditioning system the design load exists only part of the time. The CenTraVac meets smaller load requirements by automatically throttling down smoothly—and in infinitely small increments — to as low as 10% of rated capacity. It allows, for the first time, partial operation without a large penalty in operating costs! For example:

At 80% load, power consumption is 77%; at 50%, it requires 50% power; at 10% load it requires only 22% power.

It is the only unit that permits *stable* operation over such a wide range (100% down to 10% of capacity).

Yet, wide capacity control is only part of the CenTraVac story. Here are more features that make the CenTraVac a wise choice for jobs from 45 tons up.

Automatic, unattended operation. Except where required by local codes, there is no need for a special engineer. Push a button to start. From there on the CenTraVac starts, stops and modulates automatically.

No costly multi-level base required. May be set directly on a level concrete floor of sufficient strength to support unit. No foundation bolts required.

Hermetic design. Eliminates need for shaft seals, gear box, heavy thrust bearings and couplings. Minimizes danger of costly refrigerant loss. Eliminates constant supervision and maintenance.

Protection against maintenance and installation errors. CenTraVac has only two main bearings. It is designed to operate only when full oil pressure is applied to both bearings. Compressor is factory aligned, eliminating this problem in the field.

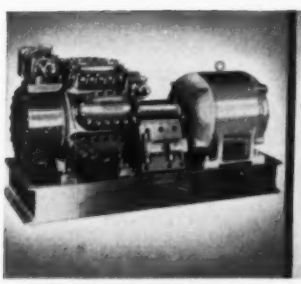
Integral load-limit control. CenTraVac has built-in load-limit control for full protection against overload under all conditions.

Packaged water chiller. CenTraVac is a complete unit. All parts are shipped together including refrigerant and oil charge. Installation requires a minimum of time.

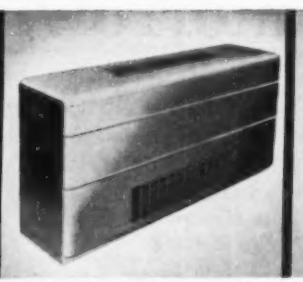
Inspect a CenTraVac installation

Your local TRANE Sales Representative will be pleased to arrange for you to see a CenTraVac in operation. Simply give him a call. For further data on the CenTraVac—including features, mechanical and engineering specifications, capacities, controls and roughing-in dimensions—contact your TRANE Sales Representative or write TRANE, La Crosse, Wis., for 42-page CenTraVac Bulletin DS-399.

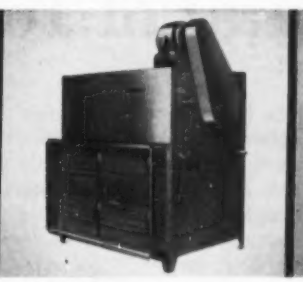
OTHER TRANE AIR CONDITIONING EQUIPMENT FOR JOBS OF ALL SIZES



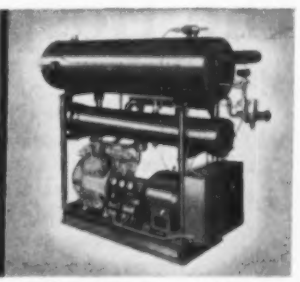
Reciprocating Compressors . . . cap. up to 50 tons. Automatic cylinder unloading saves power, permits multistep operation to 25% capacity.



UniTrane room units utilize chilled or heated water. Individually controlled for year-round air conditioning. Cabinet or recessed models.



Climate Changers . . year-round air conditioners that heat, cool, humidify, dehumidify, filter and circulate air. Capacities: 450 to 22,000 cfm.



Cold Generators . . . packaged water chillers. Completely wired, piped, charged and tested at factory. Ten sizes from 10 to 100 h.p.

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Manufacturing Engineers of Air Conditioning, Heating and Ventilating Equipment

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U.S. and 14 Canadian Offices

Architect: Louis Allen Abramson; Hospital Consultant: E. D. Rosenfeld, M.D.; Consulting Engineers: Slocum & Fuller; Mechanical Contractors: Jarcho Bros., Inc. All are located in New York, N. Y.

How Honeywell Customized Temperature Control is contributing to the development of

The Hospital of Tomorrow

The case in point is the Long Island Jewish Hospital now under construction in Glen Oaks, New York. "Features of Tomorrow" will include a double corridor arrangement (see floor plan below) that gives highly desirable separation between patient rooms and service areas, an auditorium, and closed circuit color TV for mass professional medical instruction.

But probably the most unusual feature is the radiant panel heating-*cooling* system. Subterranean water at 55° will be used for cooling, which engineers calculate will considerably reduce cost of hot weather operations.

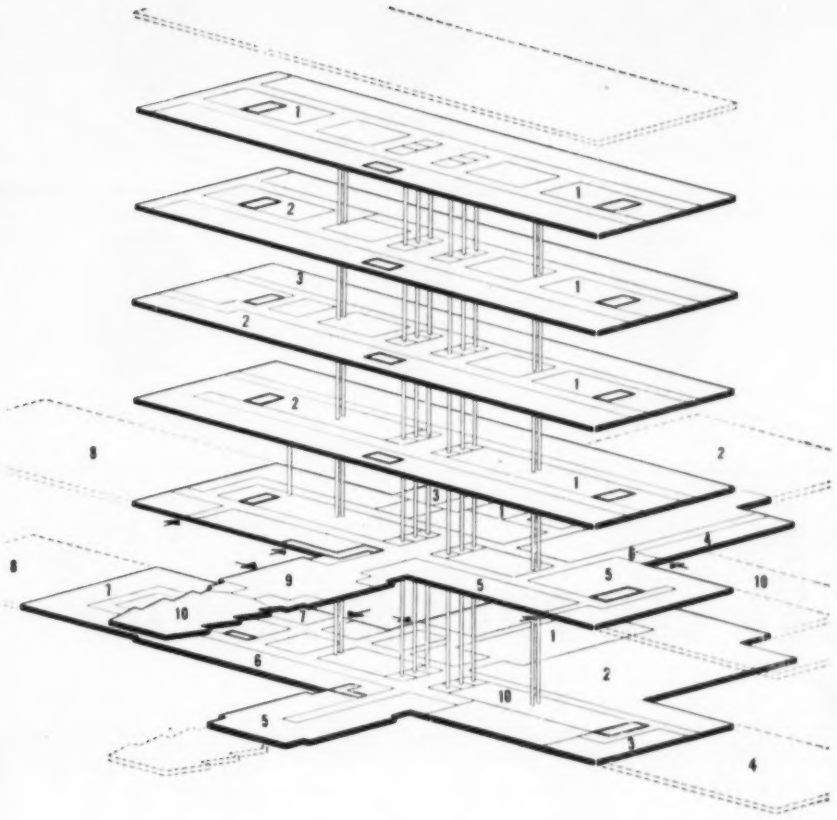
Controlling both heating and cooling will be a Honeywell Customized Temperature Control installation.

Main feature of the installation will be Honeywell's specially designed summer-winter hospital thermostat. An individual thermostat will be located in every bedroom.

Problems of humidity during the summer, and ventilation requirements, will be met by an auxiliary air handling system.

Temperature and humidity of this air will be controlled by a Honeywell Weatherstat located on the roof.

In the Long Island Jewish Hospital, the Honeywell Customized installation was *designed to fit the needs of the building.* And that's how it is with every Honeywell Customized installation—no matter what kind of building you have.



← FUTURE

6, 7, 8, 9th FLOORS & NURSING UNITS (286 beds)

← 5TH

1. 2—30-BED PRIVATE NURSING UNITS

← 4TH

1. 40-BED NURSING UNIT (surgery) 2. PEDIATRICS—46 beds

← 3RD

1. OBSTETRICS 32 BEDS—40 BASSINETTES
2. LABOR AND PREPARATION AREA
3. DELIVERY SUITE

← 2ND

1. 40-BED NURSING UNIT (medicine)
2. DIAGNOSTIC & THERAPEUTIC SERVICES

← 1ST

1. OPERATING SUITE
2. OPERATING SUITE (future)
3. CAFETERIA
4. PREMATURE NURSERY CENTER (24 bassinettes)
5. ADMINISTRATION
6. AMBULANCE RECEIVING
7. AMBULATORY SERVICE
8. AMBULATORY SERVICE (future)
9. LOBBY
10. AUDITORIUM

← GROUND

1. KITCHEN
2. CENTRAL STERILE AND MEDICAL SUPPLY
3. MAINTENANCE SHOPS
4. MAINTENANCE SHOPS (future)
5. LOCKERS
6. COMMUNICATION CENTER
7. LABORATORIES & MORTUARY
8. LABORATORIES (future)
9. PHARMACY
10. STORAGE

For comfortable, even temperature in new or existing buildings—of any size—use Honeywell Customized Temperature Control

Whether it's a hospital, apartment, school, office, factory, store—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate"—and save fuel besides.

And with a complete line of pneumatic, electric and electronic controls to choose from, Honeywell Customized Temperature Control offers you the greatest flexibility in design.

For full facts, call your local Honeywell office. Or mail the coupon direct to Minneapolis.

MINNEAPOLIS **Honeywell**

H HONEYWELL *First in Controls*

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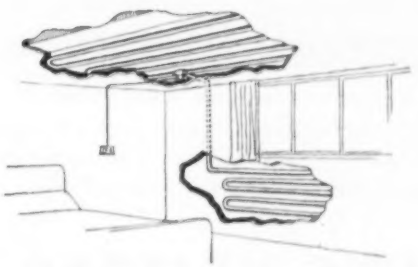

Honeywell individual room thermostats will control heating-cooling panels in bedrooms as above. Because rooms have this individual control they can always be kept comfortable—regardless of a variety of exposures, shifting winds, direction of sunshine. And with an individual thermostat in every room, doctors can "prescribe" the exact temperature needed to speed a patient's recovery.

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-12-246, Minneapolis 8, Minnesota

Gentlemen: I'm interested in learning more about Honeywell Customized Temperature Control.

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Remember, whether it is new construction or remodeling in residential, commercial, or industrial heating, Kritzer men and materials enable you to do the finest work with the greatest speed and economy. Kritzer Radiant Coils, Inc.

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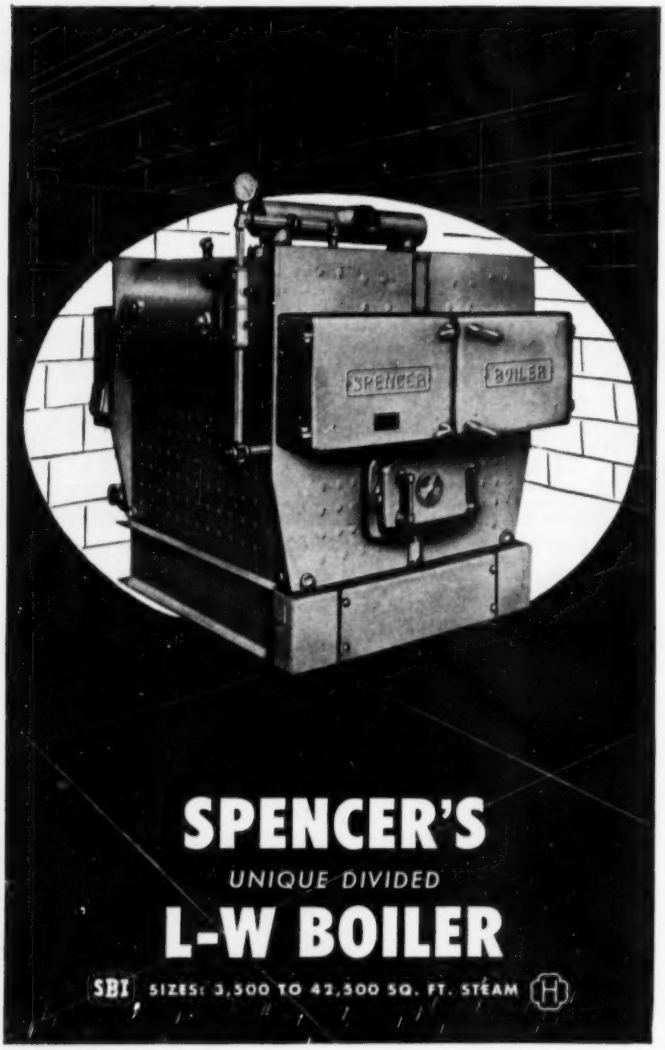

PROBLEM #1
Installation of a large boiler in an existing building with narrow basement entrance.

SOLUTION:
Spencer's Divided L-W Boiler.
Divided in half, this boiler can be moved easily through narrow doorways. Though its two watertight sections can be moved in separately, they need no welding for installation.

PROBLEM #2
Boiler installation in new building where high excavation costs make low basement ceiling imperative.

SOLUTION:
Spencer's Divided L-W Boiler.
Nearly 25% lower than conventional firebox boilers, this boiler fits into lower ceilinged basements . . . saves costly excavation.

Other time-tested advantages of Spencer's L-W Boiler

It's self-cleaning. It's fast steaming due to special staggering of fire tubes. It can be quickly converted from hand to mechanical firing.

THERE IS A SPENCER FOR EVERY BUILDING...

Problems

SPENCER "C" BOILERS

For Motels, Schools, Churches, Apartments
Commercial and Industrial Buildings
Capacity Range: 1100 to 5000 sq. ft. steam net rating
1760 to 8000 sq. ft. water net rating

PROBLEM #3
For smaller installations, provide a dependable heating boiler at low cost!

SOLUTION:
Spencer's new "C" Boiler.
A commercial boiler that sells close to residential prices, Spencer's "C" Series is your answer to the cost problem. Similar in design to Spencer's heavy-duty commercial units, the new "C" contains two complete passes of fire tubes and is available with standard 15" base or extra base heights at nominal charge.

Other outstanding features of the "C" Boiler

Water-cooled precision-ground flue and fire-door frames, equipped with heavy cast-iron, insulated doors; extra-heavy steel-plate smokeboxes; staggered boiler tubes for rapid heat transfer.

For any heating problem—Spencer offers a complete line of heating boilers, for every building, for every fuel. For more information about Spencer products designed to give top performance on any job, use the coupon at right.

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For specifications and more information about Spencer's many lines of boilers:

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Spencer Heaters, Dept. HP-12-3
Lycoming-Spencer Division
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Williamsport, Pennsylvania

Dear Sirs:
Please send me specifications and additional information on the boilers checked off below:

- ☐ Spencer's "C" Series
- ☐ Spencer's Divided L-W Series
- ☐ Spencer's Other Commercial Boiler Lines

Name_____
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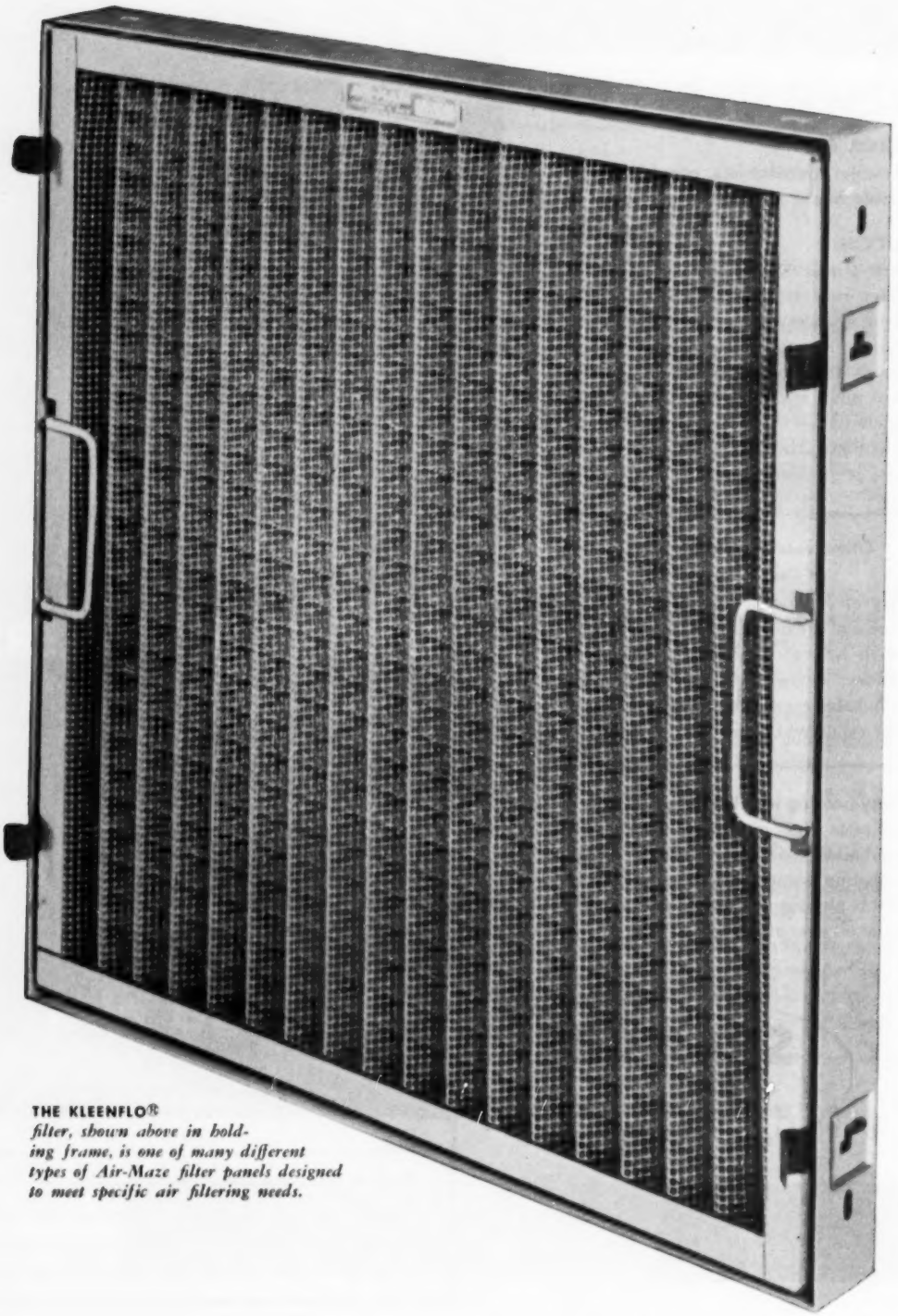
City_____ Zone_____ State_____

As Ben Franklin might have put it:

"These 18 littles



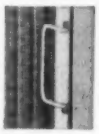
THE KLEENFLO®
filter, shown above in holding frame, is one of many different types of Air-Maze filter panels designed to meet specific air filtering needs.

make a mickle"

ONE OF BEN FRANKLIN'S famous sayings was, "Many a little makes a mickle." It means that many little things add up to a lot. Air-Maze believes that's true. That's why we build so many little "extras" into our filter panels and holding frames. Separately, they're not of vital importance. Together, they make a big difference —in the life of the panels, in the way they filter, and in the cost of servicing them. Here are some of these Air-Maze extras:

1. CORROSION RESISTANT PAINT ON ENCLOSING CHANNELS. Even a stripping tank won't remove this paint.

2. STAMPED ENCLOSING CHANNELS FOR EXTRA STRENGTH without excessive weight. Less chance of damage during handling.



3. FOLDING HANDLES are less likely to be damaged. Panels can be stacked flat because handles fold flat. Handles are easily removable so that if damage does occur there's no need to weld or rivet a new handle on.

4. ENCLOSING CHANNEL HAS INDENTED AND OVERLAPPED CORNERS. This is done before welding to give extra strength and provide a perfectly smooth sealing surface around the perimeter of the filter. Air can't by-pass between holding frame and enclosing channels.

5. ADJUSTABLE SPRING CLIPS ON HOLDING FRAMES can take panels of different thicknesses. Clips hold panels snug, insuring best sealing possible. Fastener is specially designed so it can be quickly replaced in case of breakage.

6. STAMPED INDENTATIONS in the bottom of the holding frame keep the filter accurately centered in the holding frame.

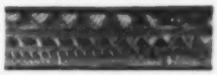
7. OIL-RESISTANT SPONGE NEOPRENE GASKETS are rot-free and fungus-free. Extra-wide gaskets prevent dirty air from by-passing the panel.

8. MEDIA CAN'T COME OUT or get in the air stream. It can't settle or "channel" to leave openings. Dirt always has to contact the media, never gets through.

9. MEDIA IS GALVANIZED for corrosion resistance. Media of aluminum, bronze and stainless steel materials are also available.

10. MEDIA IS ALL-METAL and cleanable. It will last indefinitely, needs no replacement.

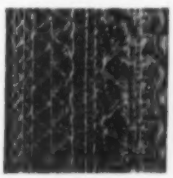
11. SCIENTIFICALLY CRIMPED SCREEN CLOTH presents more filtering surface to dirty air than other types of media of equal thickness.



12. ROUND MEDIA WIRES enable you to flush out dirt and fibrous material during cleaning with speed and ease.

13. LARGE VERTICAL OPEN TROUGHS are provided by media crimps so cleaning solution flows and drains easily.

14. ADHESIVE TAILORED FOR YOUR FILTRATION JOB. A number of different adhesives are available. We'll help you pick the best for your filtering needs.



15. PROGRESSIVE DENSITY MEDIA DESIGN has exceptional dirt holding capacity. Layers of wire screen are arranged so each filtering layer is denser that the one before.

16. MANY DIFFERENT MEDIA DESIGNS are available from which to choose the one that's best-suited to your particular filtering needs.

17. DRAIN HOLES in all corners of Air-Maze filters insure quick drainage when cleaning and re-oiling.

18. TRUSS HEAD SCREWS and speed nuts in holding frames are used for easier, faster installation. Oval holes provide leeway, make quick alignment of filter and frame easier.

Make sure the next filter panels you buy give *all* these plusses. And for help in working out the best answer to your filtration problems, call your nearby Air-Maze representative or write Air-Maze Corp., Cleveland 28, Ohio.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

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The Filter Engineers

LIQUID FILTERS
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On 24-hour Duty in HOSPITALS

JOHNSON CONTROL

Automatically provides

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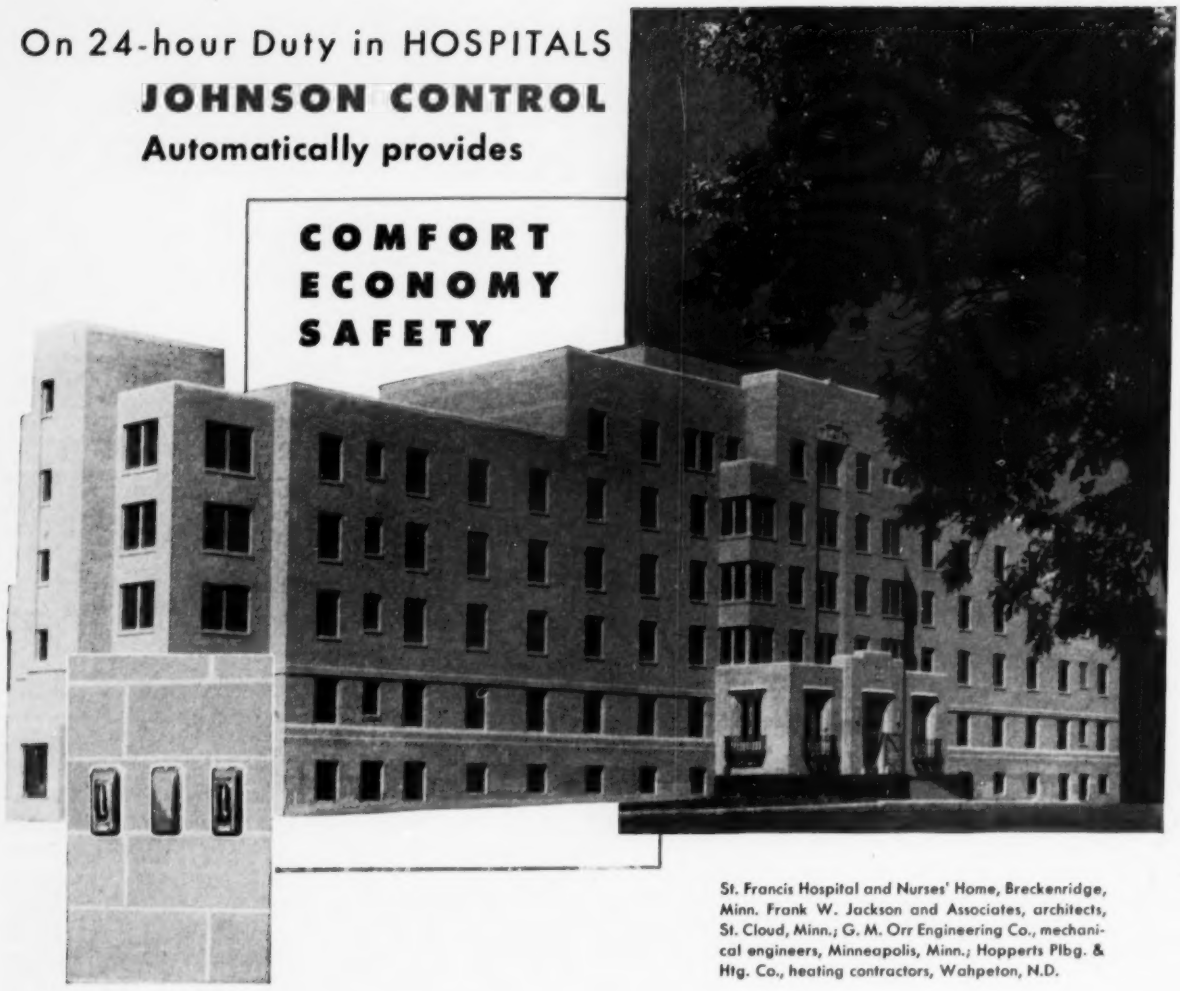
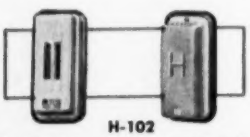


St. Francis Hospital and Nurses' Home, Breckenridge, Minn. Frank W. Jackson and Associates, architects, St. Cloud, Minn.; G. M. Orr Engineering Co., mechanical engineers, Minneapolis, Minn.; Hopperts Plbg. & Htg. Co., heating contractors, Wahpeton, N.D.

The comfort and health of patients, at St. Francis Hospital in Breckenridge, Minn., are constantly guarded by Johnson Automatic Temperature and Humidity Control. Here, the exact temperatures and humidities required in operating rooms, obstetrical rooms and other vital areas are maintained by Johnson Thermostats and Humidostats operating Johnson Valves and Dampers. Like all Johnson Control Systems, this installation was designed *and installed* by Johnson to meet the specific requirements of the control problems encountered in this particular building.

Because it is *pneumatically* operated, Johnson Control meets the most exacting hospital safety requirements. Completely safe, even in the presence of explosive anesthetic gases. And, Johnson Humidity Control guards against the dangers of static electricity.

Whether *your* problem involves the control of temperatures and humidities in a single operating room or an entire hospital, call a Johnson engineer from a nearby branch office. There is no obligation, of course. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

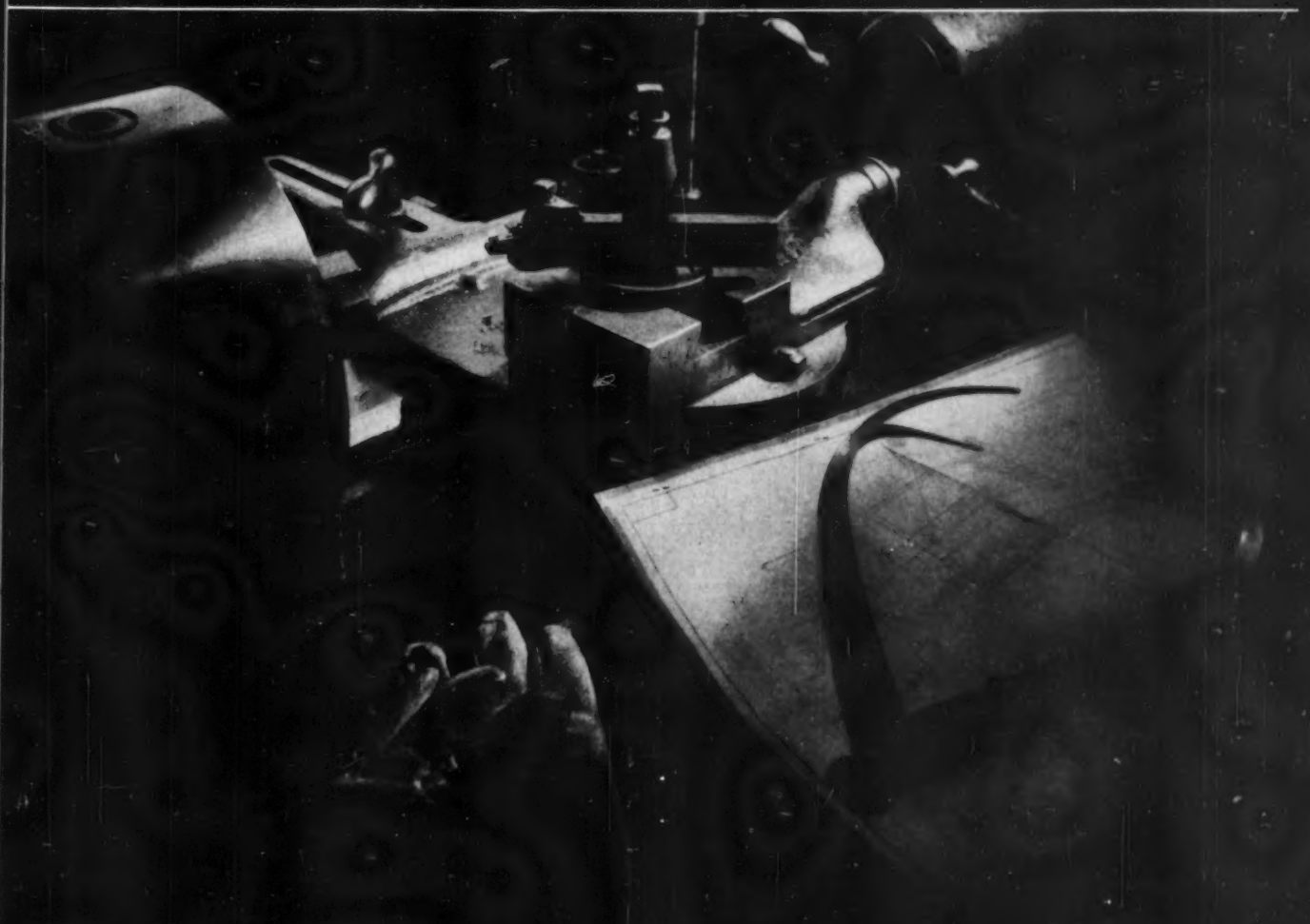


T-403 Room Thermostat H-102 Room Humidostat

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

WHY IT PAYS TO BUY STEEL FROM WAREHOUSE



You don't lose production time waiting for steel!

WHEN YOU BUY STEEL FROM WAREHOUSE, YOU GET:

- LOWER INVENTORY COSTS
- LOWER SPACE COSTS
- LOWER TIME COSTS
- LOWER CAPITAL INVESTMENT
- FASTER PRODUCTION
- FEWER INVENTORY LOSSES

You don't have to adjust your production schedule to match mill rollings when you use a U. S. Steel Supply warehouse as your own. We can make deliveries to suit *your* convenience. The stocks in our *local* warehouse and the resources of our 14 other warehouses promise delivery of the steel you need when, where and in the condition you want it. Contact your U. S. Steel Supply salesman.

U. S. STEEL SUPPLY

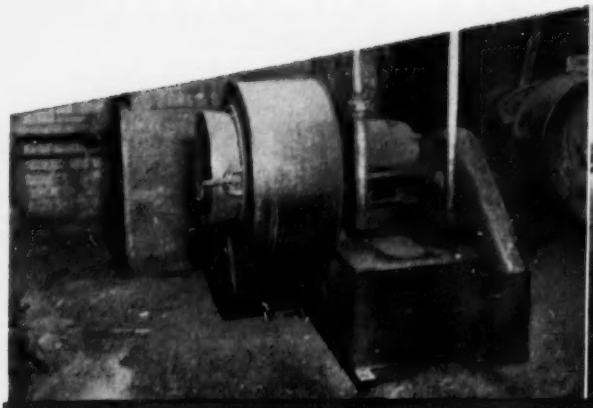
DIVISION

General Office
208 So. La Salle St., Chicago 4, Ill.

USS

Warehouses and Sales Offices Coast to Coast

UNITED STATES STEEL



To Cut Down on Your Call-Backs...

Quiet, dependable Century MOTORS for Heating and Ventilating Equipment

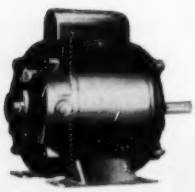
One way to save time and avoid complaints is to make sure the equipment you install has proper motor-power to operate quietly and efficiently.

To assure this customer-pleasing performance, many manufacturers equip their products with Century motors. The wide range of Century motor types and sizes allows them to select motors that are *exactly right* for every job . . . motors that bring out the best in their equipment.

For long-lasting customer satisfaction . . . specify Century C MOTORS

When you see Century motors on heating, ventilating or air conditioning equipment it's a sign that the motor-power is engineered as carefully as the product itself.

CENTURY ELECTRIC COMPANY
1806 Pine Street • St. Louis 3, Missouri
Offices and Stock Points in Principal Cities

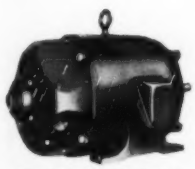


Capacitor, Single Phase Motors
¼ to ½ h. p.

Split Phase, Single Phase Motors
⅓ to ½ h. p.

Open, Drip Proof, General Purpose Motors
400 to ½ h. p.

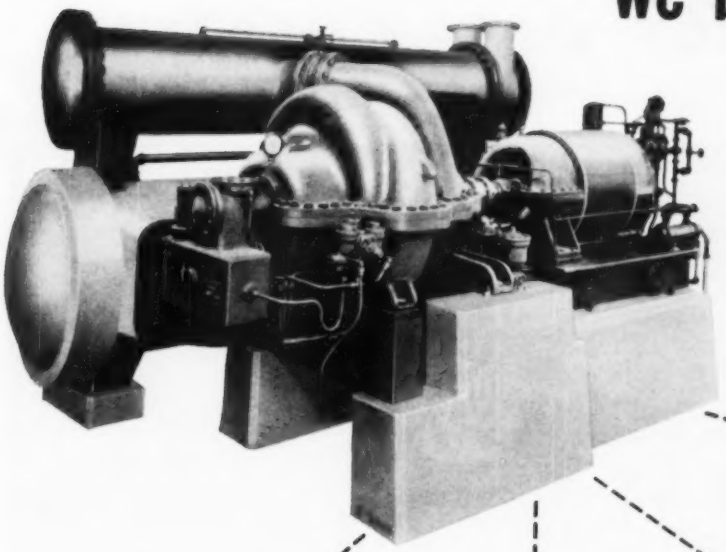
Splash Proof, Polyphase Motors
400 to 1 h. p.

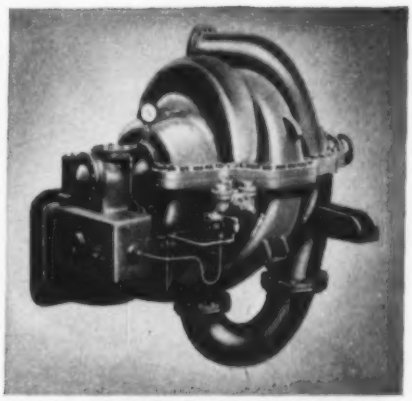


Repulsion Start, Induction Single Phase Motors
1½ to ½ h. p.

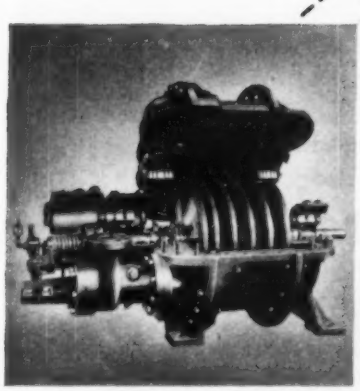
-777

We know it'll do a job for you . . . we built all of it!

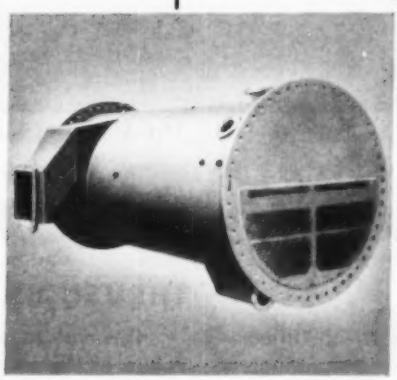




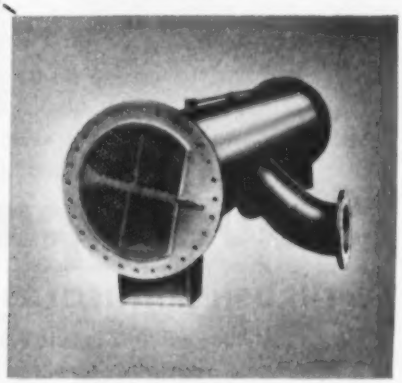
INCREASED EFFICIENCY results from volute design of the Worthington centrifugal compressor. Smooth, obstruction-free passage for gas reduces friction and turbulence losses.



TYPICAL WORTHINGTON MULTI-STAGE steam turbine, ideally suited for compressor-drive applications.



OVERALL SAVING in power consumption is made possible by the flash pre-cooling chamber in the Worthington cooler.



WORTHINGTON CONDENSERS are of the horizontal shell-and-tube type, with water inside the tubes and refrigerant gas outside.

Every major component in a Worthington centrifugal refrigeration system is designed, engineered and built at the Worthington plant. Worthington, for example, is the only manufacturer that builds drives as well as compressors.

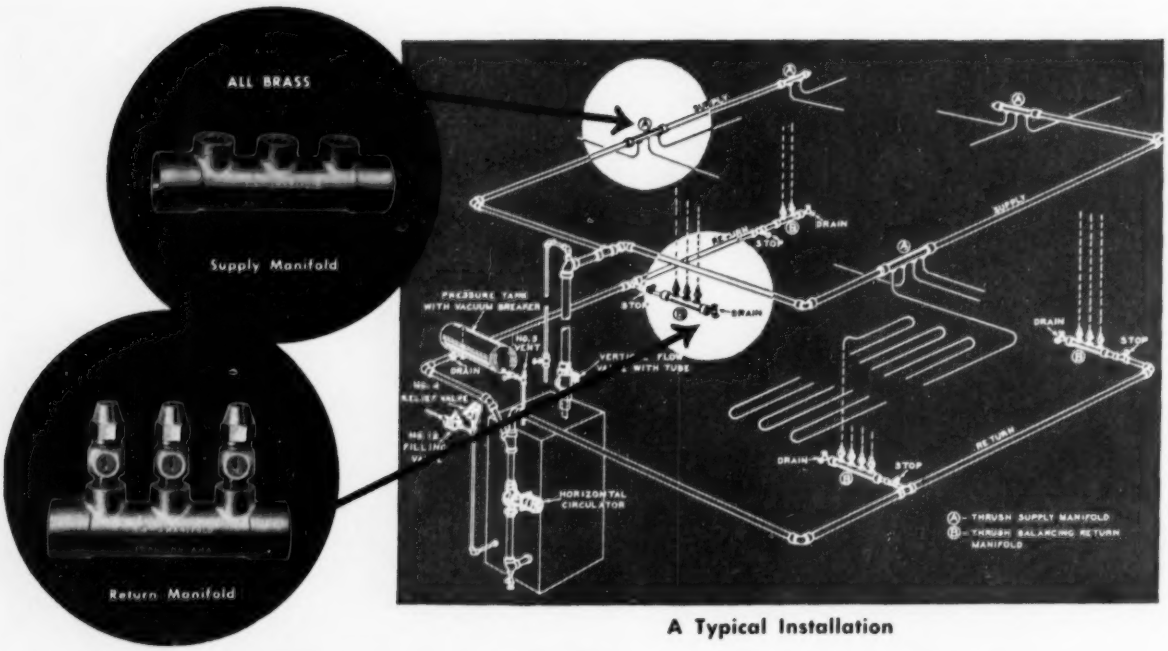
This is one big reason why leaders in industry are turning more and more to Worthington centrifugal refrigeration systems. Present-day installations include CBS Television City; the new Alcoa Building, Pittsburgh; Saks Fifth Avenue; the Hotel Commodore, and the General Petroleum Building in Los Angeles.

Worthington also makes condensers, coolers and auxiliary equipment such as steam condensers, condensate pumps, steam jet air ejectors and step-up gear sets. Write for free Centrifugal Refrigeration Bulletin C-1100-B14 to Worthington Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey. A-3-41

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

new THRUSH products to SIMPLIFY RADIANT HOT WATER HEATING



A Typical Installation

Save Space, Time and Labor

THRUSH MANIFOLDS

Installing radiant coils is easier with Thrush Manifolds. They save time, space and fittings. Available in 1" and 1¼" sizes, each with two, three or four ⅜" or ½" threaded branch outlets. Ends have solder connections. Thrush Manifolds are used in both supply and return lines.

THRUSH BALANCING VALVES

It is easy to balance radiant coils with these valves in the Manifolds. They permit the individual filling of each coil and save time. Air is eliminated quickly and completely. Positive shut-off. Flared fittings for ⅜" and ½" tubing. See your wholesaler or use the coupon below.

for better balanced heating

H. A. **THRUSH** & COMPANY

mail coupon now

H. A. THRUSH & COMPANY • DEPT. E-12 • PERU, IND.

Please send us illustrated bulletin on Thrush Manifolds and Balancing Valves.

NAME ADDRESS

CITY STATE

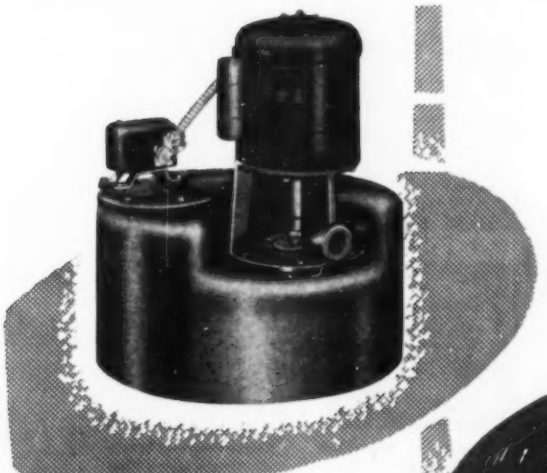
SKIDMORE'S latest contribution

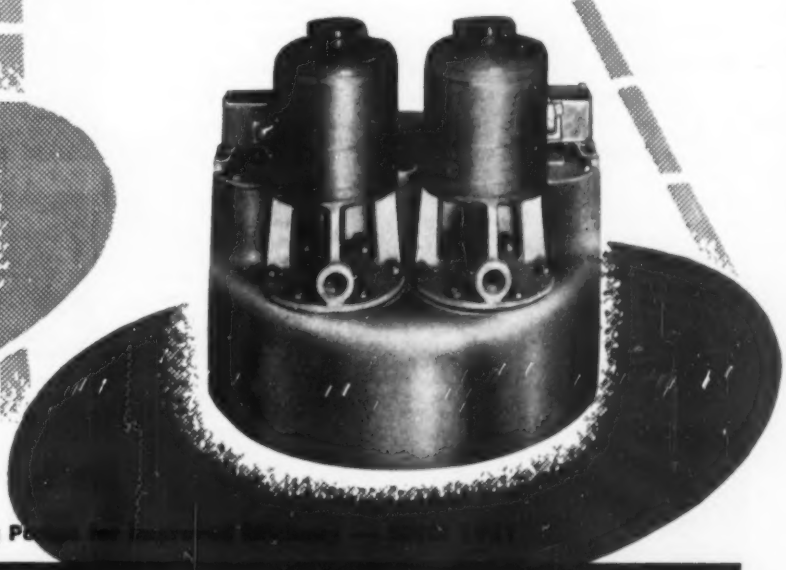
MAINTAINED SKIDMORE PUMPS EFFICIENCY

THE NEW "CV" DUPLEX UNIT --- TAKES THE SPOTLIGHT!

A worthy complement to the popular "CV" single unit and a fine addition to the Skidmore family. Equipped with either individual float switches or automatic alternating float switch, the new Skidmore Duplex Unit now provides a simple positive means of alternating the operation of two pumps installed on a duplex unit with a common receiver, and insures even wear of the pumping unit. The Duplex Unit incorporates all the desirable features of the single unit. Compact and dependable, the unit requires a minimum of space and offers wide range of selectivity . . . this adds up to low installation cost and long trouble-free service. Pump is bronze fitted with enclosed centrifugal impeller, stainless steel shaft, self lubricating bronze bearing and low return connection.

Left—Type "CV" Single Unit
Right—Type "CV" Duplex Unit





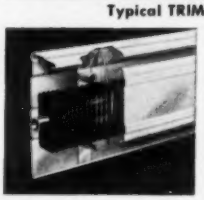
WRITE FOR NEW BULLETIN NO. 21-A
Contains engineering data on the Single and the Duplex Units.

Skidmore Heating P

SKIDMORE CORPORATION ● ST. JOSEPH, MICHIGAN

Vulcan's NEW, TRIMLINE COVER is designed for enduring beauty . . . built to harmonize with any residential decor. The STREAMLINED top of cover reduces apparent depth. Front easily removed for cleaning. Rod hangers give complete freedom of movement for suspension. TRIMLINE baseboard requires fewer joints, less fittings and accessories. Dampers may be installed anywhere, any time, on the job.

Typical TRIMLINE installation



Rod hanger . . . adjustable for any type construction

Cover snaps on brackets. Simple installation

*Trade-mark Reg.

Vulcan TRIMLINE baseboard is ideal for residential installation. It's so sleek that furniture can be arranged without affecting the radiation of heat. All floor space, LIVING space, with TRIMLINE!

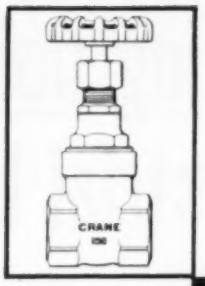
Also made in Canada under trade name of Heal Radiation by Vapor Car Heating of Montreal

NEW VULCAN CATALOGS

Send for new Vulcan Radi-Vector Catalog No. 54 (residential), Unievector No. 623 A (commercial) describing Vulcan elements, enclosures and accessories.

The VULCAN Radiator Co.
26 Francis Ave., Hartford 6, Connecticut

NEW* brass gate valves by CRANE



No. 410,
100-Pound

No. 438,
125-Pound

No. 437,
150-Pound

* NEW SHAPE... NEW STRENGTH

for 3 All-Time CRANE *favorites*

Here are valves that didn't have to be changed . . . because each has long been the best in its class. But Crane found ways of improvement to give you an even better buy for your brass valve dollars.

For example—here is greater strength, greater rigidity, made possible by the new cylindrical upper body . . . the same basic shape as high-pressure steel valves. Here, too, is an improved stuffing box that screws *into* the bonnet—also better stem support to assure truer alignment and minimize wear on the packing.

And not to be overlooked is their clean, modern appearance—a very desirable advantage for all of your "exposed" installations. Sizes ¼ to 3 in. Ask your Crane Representative all about this improved brass valve line next time he calls.

just off the press...
new four-page folder with complete facts including sizes, prices and dimensions. Send for yours today. Ask for Brass Valve Folder AD1944.

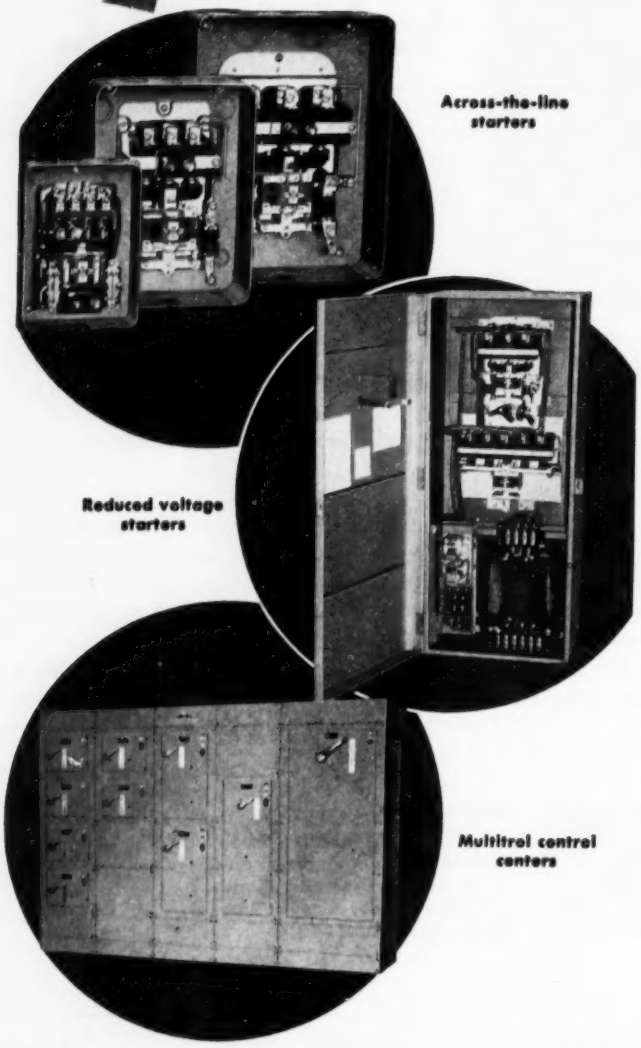
THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES · FITTINGS · PIPE · PLUMBING · HEATING

Here's a sound starting point for air conditioning, industrial heating, and refrigeration sales



Across-the-line starters

Reduced voltage starters

Multitrol control centers

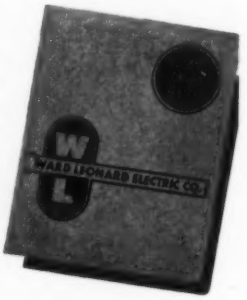
In the long run, leading users of motor starting equipment have found it highly profitable to specify motor controls made by Ward Leonard.

Why? Because installation of Ward Leonard starters is easy, performance is trouble-free, operating life is exceptionally long and maintenance is simplified.

Ward Leonard manufactures a complete line of dependable motor starters for refrigeration, air conditioning and industrial heating applications. Here are the five distinct types of Ward Leonard starters:

Bulletin 4110 – a-c across-the-line magnetic – non-reversing, 200 hp max.
Bulletin 4170 – a-c Primary resistance, 200 hp max.
Bulletin 4190 – a-c Autotransformer, 200 hp max.
Bulletin 4340 – a-c Part Winding, 400 hp max.
Bulletin 4410 – Multitrol control centers NEMA size five, 600 v. max.

For full particulars on these and other motor controls, send for your copy of Ward Leonard's Motor Control Catalog. Ward Leonard Electric Co., 24 South St., Mount Vernon, N. Y.



WARD LEONARD ELECTRIC COMPANY
MOUNT VERNON, NEW YORK

RHEOSTATS RELAYS RESISTORS CHROMASTER

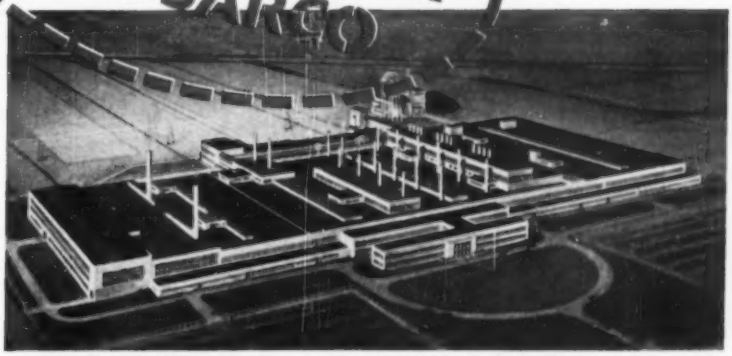
Result-Engineered Controls Since 1892

Ward Leonard's complete engineering text book, "Handbook of Power Resistors," $3. per copy.

The most convincing stamp of user satisfaction

ANOTHER REPEAT ORDER FOR SARCO

now another Ford Plant



Ford Foundry, Cleveland. *Architects and Engineers:* F. A. Fairbrother and George H. Miehls. *Consultants.* Albert Kahn Associated Architects and Engineers, Inc., Detroit. *Heating Contractors:* Smith and Oby Co., Cleveland.

equipped with Sarco heating specialties

8 Ford Plants now rely on Sarco dependability

To get repeat business it takes more than just promises of product performance . . . *it takes proof.*

For the past fifteen years Sarco product performance has been proved seven times over to the Ford Motor Company. Now the new Cleveland Foundry is the eighth Ford plant to be equipped with Sarco Heating Specialties. Over 7,000 steam traps, strainers, radiator valves and traps and other Sarco Specialties give dependable, efficient service in all eight plants.

Doesn't this repeat business speak for itself?

Specify Sarco Heating Specialties on your next job and be assured of complete customer satisfaction. Full details of all Sarco products are available on request.

Other SARCO-EQUIPPED plants of the Ford Motor Company

DEARBORN, MICHIGAN, *Ford Styling Building*
CLEVELAND, OHIO, *Engine Plant*
WAYNE, MICH., *Lincoln-Mercury Assembly Plant*
BUFFALO, N. Y., *Ford Stamping Plant*
DALLAS, TEXAS, *Ford Assembly Plant*
KANSAS CITY, MISSOURI, *Ford Aircraft Plant*
METUCHEN, NEW JERSEY, *Lincoln-Mercury Assembly Plant.*

Here's why so many architects, engineers and heating contractors specify and install Sarco

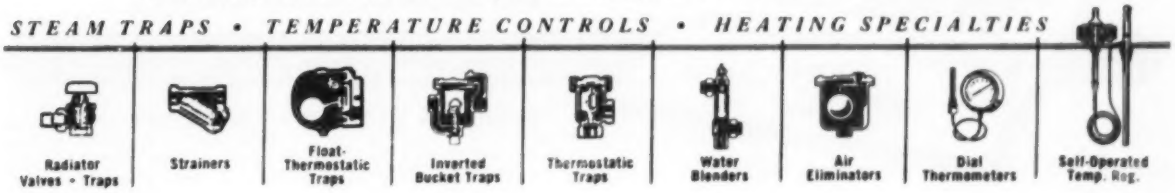
— job after job.

- **Proven dependability**
- **Trouble-free service**
- **Complete line from one reliable manufacturer**
- **Nationally known and preferred**

SARCO SAVES STEAM

SARCO COMPANY, INC., Empire State Building, New York 1, N. Y.
Sarco Canada, Ltd., Toronto 8, Ontario . . . Represented in Principal Cities

STEAM TRAPS • TEMPERATURE CONTROLS • HEATING SPECIALTIES

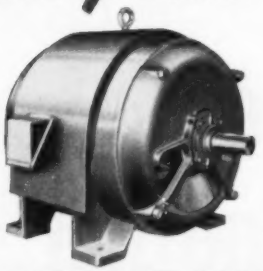


Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

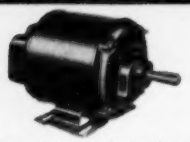
Wagner Quality Motors *for your product or your plant*

Whatever your motor requirements may be—single-phase or polyphase, 1/125 hp or 400 hp—Wagner can offer a standard motor that is entirely dependable in its specific application. The wide variety of motors shown here is typical of the many motors and motor modifications in the complete Wagner line.

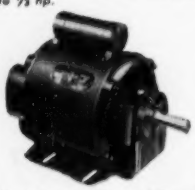
At right is TYPE RP—open type polyphase squirrel-cage motor. It is drip-proof and suitable for all general purpose applications. 1/6 to 400 hp.



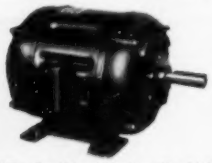
SINGLE-PHASE



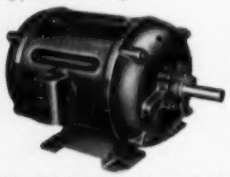
TYPE RB—*Split-phase Induction. For easy starting applications with high starting current. 1/20 to ⅓ hp.*



TYPE RK—*Capacitor-Start Induction. For general purpose applications requiring high starting torque—normal starting current. 1/6 to 5 hp.*

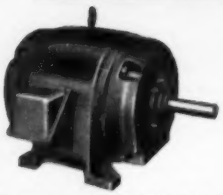


TYPE RG—*Repulsion-Induction. For high starting torque applications involving a very long starting period. 1 to 5 hp.*

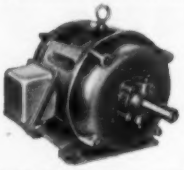


TYPE RA—*Repulsion-Start Induction. For general purpose applications with high starting torque—low starting current. ½ to 15 hp.*

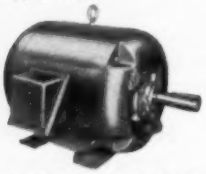
POLYPHASE MOTORS



TYPE XP—*Splashproof. Protected against splashing or dripping liquids. ¾ to 200 hp.*

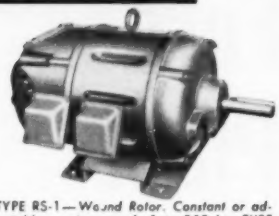


TYPE TP—*Totally-enclosed, non-ventilated. Fully protected. ¼ to 15 hp.*

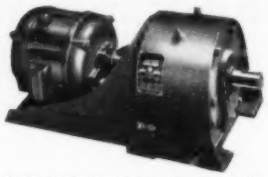


TYPE CP—*Totally-Enclosed Fan-Cooled. Protected against dirt, chips, abrasives or fumes. Steel frame. 1 to 250 hp. Also in explosion proof type HP.*

TYPE EP—*Corrosion-resistant Totally-Enclosed Fan-Cooled. Cast iron frame. 2 to 250 hp. Also available in explosion proof type JP.*



TYPE RS-1—*Wound Rotor. Constant or adjustable varying speed. 1 to 250 hp. TYPE RS-2 for intermittent service. 2 to 200 hp.*



GEAR MOTORS—*Single-phase or Polyphase. Open or enclosed types. 1/20 to 50 hp.*

* * *

In addition to a complete line of motors, Wagner also furnishes Increment Type Motor and Starter Combinations, Jet Pump Motors and a complete line of Transformers: Dry-type, Distribution and Power. Wagner engineers welcome an opportunity to serve you. Consult the nearest of our 32 Branch offices, or write direct.

Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

M53-14

for perfect heat distribution

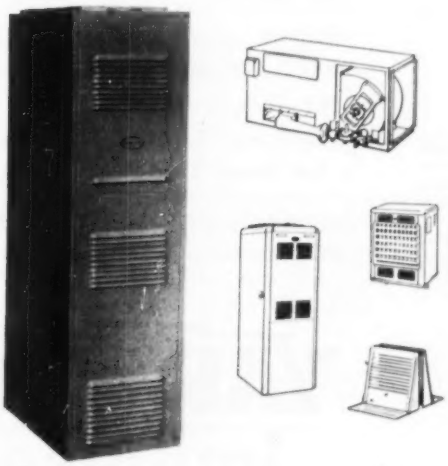
UTILITY'S NEW COUNTERFLOW FURNACES

You've wanted perimeter heating... combined with compactness and practicality. Now Utility offers you both in its new Counterflow Furnaces, capacity 70,000 and 105,000 BTU.

Here's greater power and more effective heat distribution – the result of Utility's oversize blower... more economical, more efficient and quieter operation, thanks to Utility's Sy-lent* Heat Exchanger.

For perimeter and all low-duct installations, compare Utility's Counterflow with every other available type. For efficiency, ease of installation, low cost, and freedom from service problems, you'll choose Utility's Counterflow Furnaces to "sell the job." AGA-approved.

*Pat. Pending



See the complete UTILITY heating line now.

UTILITY
TRADE MARK

UTILITY APPLIANCE CORP.
4851 S. Alameda St., Los Angeles 58, Calif.

MANUFACTURERS OF GAFFERS & SATTLER AND OCCIDENTAL AUTOMATIC GAS RANGES • UTILITY AUTOMATIC GAS HEATING EQUIPMENT • UTILITY AUTOMATIC GAS WATER HEATERS • UTILITY AIR COOLERS AND BLOWERS

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Please send me free information on:

- ☐ Utility Automatic Heating Equipment
- ☐ Utility Cooling Equipment
- ☐ Utility Automatic Gas Water Heaters

Name_____

Address_____

City_____ Zone____ State_____

3000 impulses help keep mid-west refinery "on stream"

This little valve—the only moving part—actually floats on the condensate load, discharges each tiny bit of condensate as it forms, keeps hot steam in the equipment every minute of operating time.

THIS big refinery at Lawrenceville, Ill.—like a lot of other important refineries — uses Yarway Impulse Steam Traps.

Over 3000 Yarway Impulse Traps are installed on tracer lines and for draining steam headers.

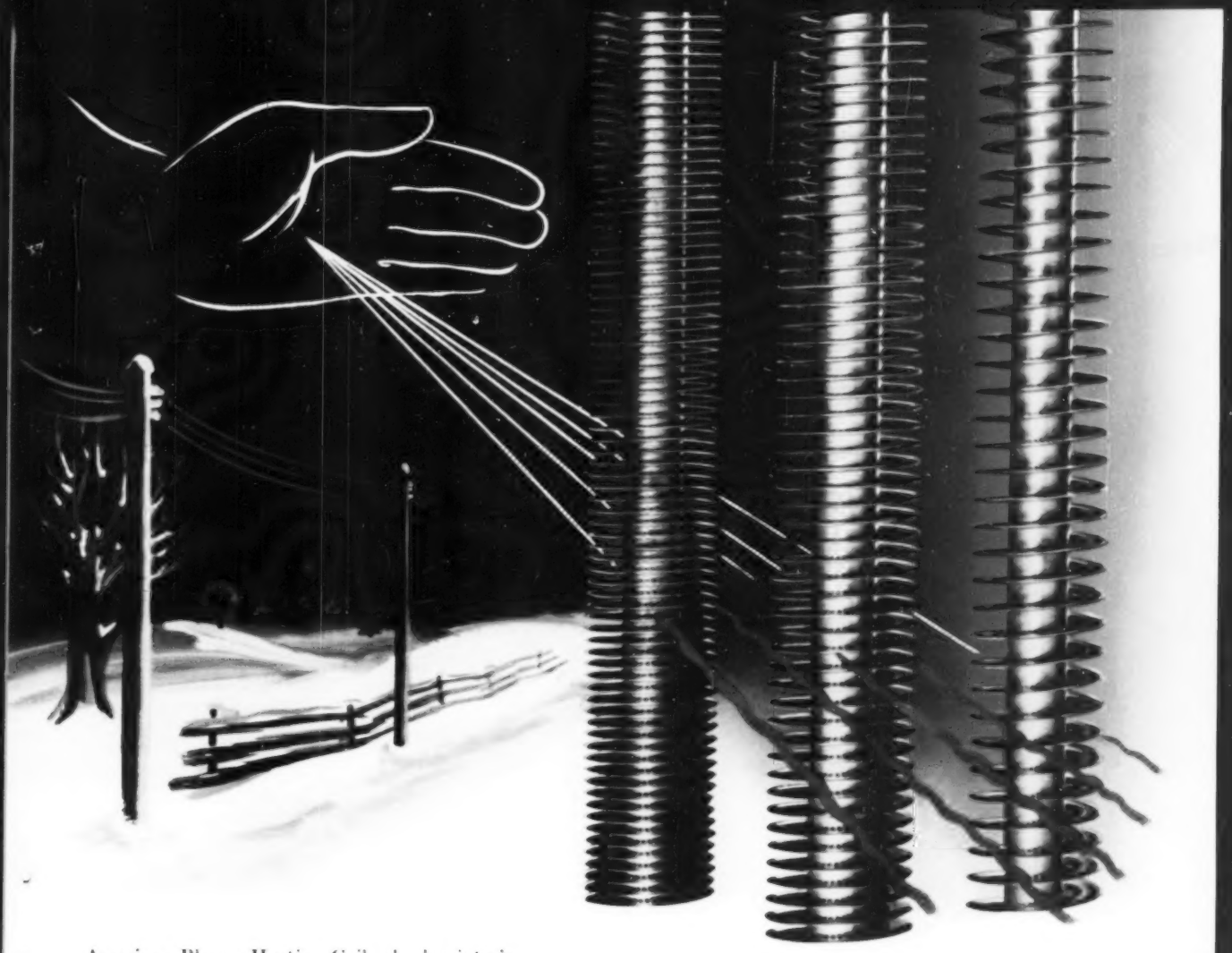
Popular features of the Yarway Impulse Steam Trap are its ability to get equipment *hot in a hurry*—and keep it hot! . . . also its small, handy size—fits in easily in any location; its stainless steel body and working parts; quick installation; easy maintenance; low initial cost.

Another advantage—IMMEDIATE DELIVERY from 250 local distributors, plus quick service from nearby Yarway field engineers.

More than 900,000 Yarway Impulse Steam Traps have been sold. For a free Steam Trap Selector, write . . .

YARNALL-WARING COMPANY
107 Mermaid Ave., Philadelphia 18, Pa.

YARWAY® impulse® steam trap



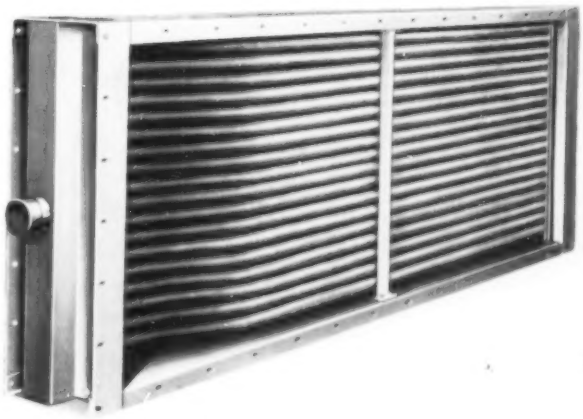
American Blower Heating Coils check winter's icy hand.

They're quality-built. All tubing is helically wound with copper or aluminum fins in three standard spacings (see above). Coil casings are made of heavy galvanized steel; headers are of die-formed steel.

Whether you need coils for blast heating, zone reheating or whether you want return bend coils or coils for modulated steam control—you'll find the size and type that best fits your needs in the American Blower line. Write for further data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation



Type S Steam Coil for normal blast heating. Tested and guaranteed for operation with steam up to 200 lbs. gauge pressure and 450°F temperature. Die-formed tube support protects tubes. Write for Bulletin B-1218.

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

A GOOD BENDER IS A "MUST" - BUT A PERFECT JOB DEPENDS ON

GOOD PIPE-

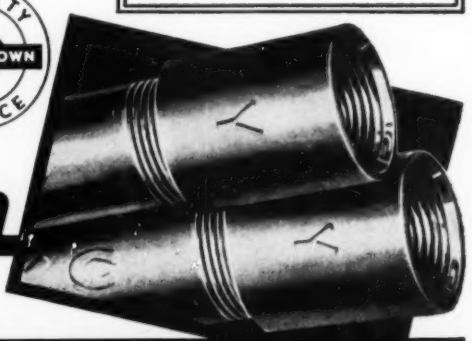
7 POINTS OF UNIFORM GOODNESS IN

YOUNGSTOWN STEEL PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

ON a radiant heating job, it's a pleasure to work with Youngstown pipe. It bends readily to a true arc without flattening. That's because it is uniformly soft and ductile, and soundly welded in manufacture by the Youngstown continuous-weld process. The name "Youngstown", rolled into every length, is your assurance that it's GOOD PIPE.

QUALITY V YOUNGSTOWN SERVICE

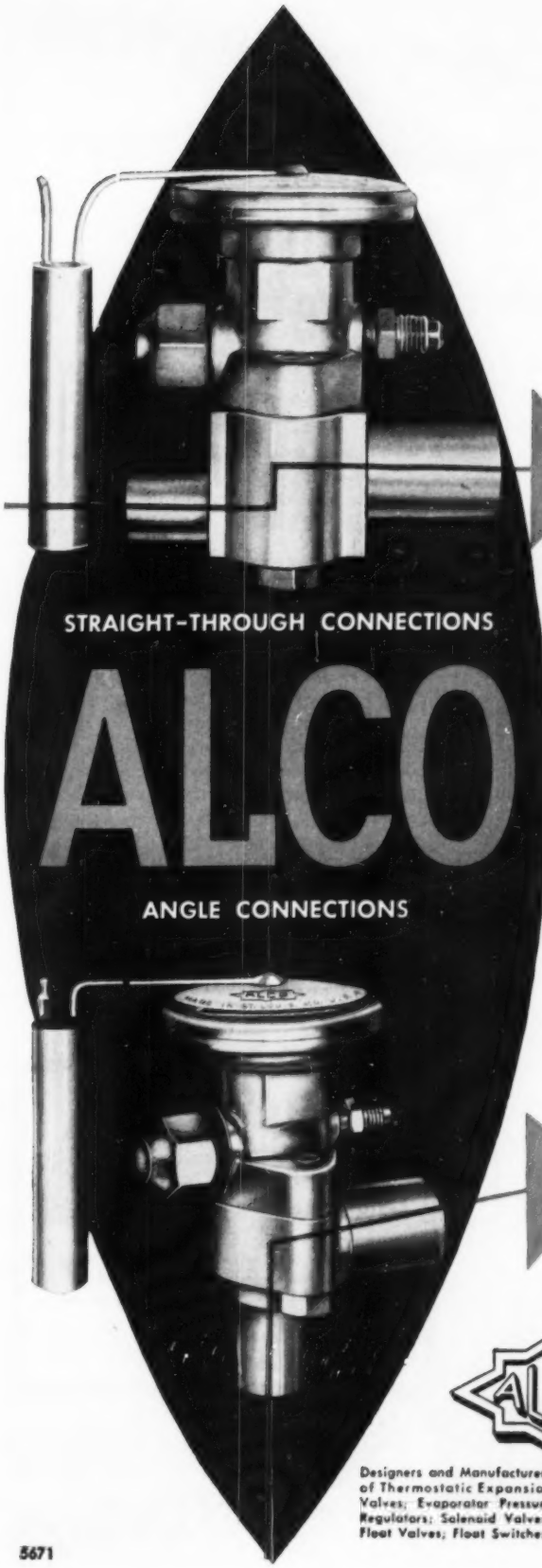


Youngstown STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES



Save Installation Time!

"T" SERIES THERMO VALVES

available in 2 types:

- **STRAIGHT-THROUGH CONNECTIONS**
- **ANGLE CONNECTIONS**

Now you can choose the "T" Series Valve that best fits each job—any location.

inside...they're identical

Parts are interchangeable.

They're simple to service without removing the body from the line. To adjust superheat, just unscrew the seal cap and turn the stem.

Available for all temperature ranges—all operating conditions.

Write for further information today.

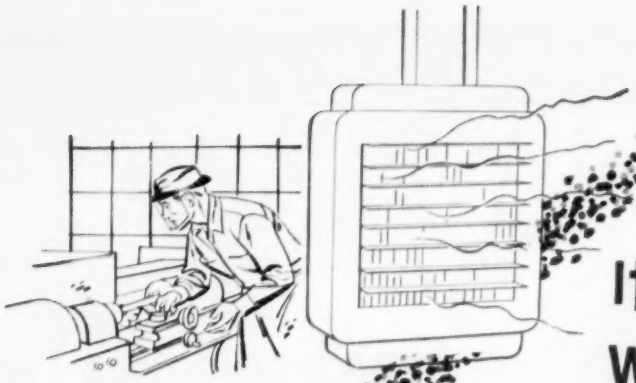
SEE YOUR ALCO WHOLESALER

ALCO VALVE CO.

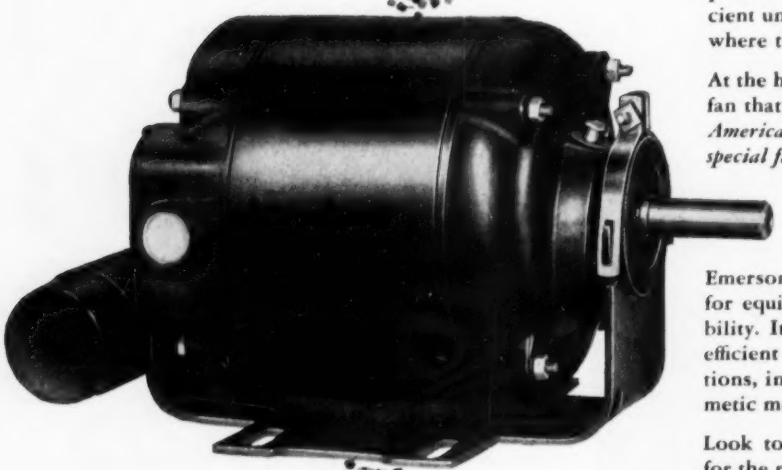
861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

5671



It tells heat where to go!



It would be a cold day in many an industrial plant without modern unit heaters. These efficient units pour out warmth and comfort right where they are needed.

At the heart of each unit is a quiet, dependable fan that sends the heat on its way. *On many of America's best known unit heaters Emerson-Electric special fan-duty motors power the fans.*

Emerson-Electric specializes in building motors for equipment with a reputation for dependability. It has done so for 63 years, and offers efficient motors for a wide variety of applications, in ratings from 1/20 to 5 h.p., and hermetic motors ⅛ to 20 h.p.

Look to Emerson-Electric if you are looking for the right motor to power your product efficiently, dependably. Your inquiry is invited.

THE EMERSON ELECTRIC MFG. CO.
St. Louis 21, Mo.

Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ 460-A Capacitor-Start
- ☐ 460-B Split-Phase
- ☐ 460-C Integral
- ☐ 460-D Fan-Duty
- ☐ 460-E Oil-Burner
- ☐ 460-F Jet Pump
- ☐ 460-G Blower

EMERSON ELECTRIC
MOTORS • FANS — APPLIANCES

ALOYCO

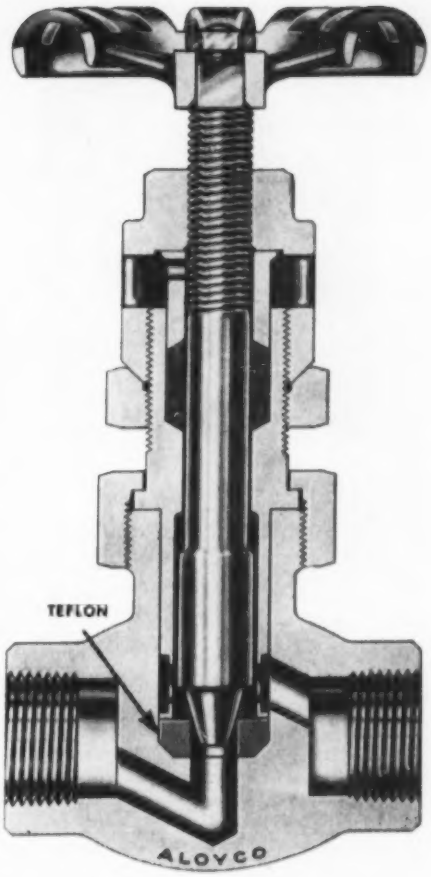
"TEFLON"-seated valves give Longer Operating Efficiency

The critical problem of leakage in small valves used for metering, instrument lines, and sampling of corrosives has been solved by the new ALOYCO design features shown here: renewable Teflon seats and exterior threading completely out of the fluid zone.

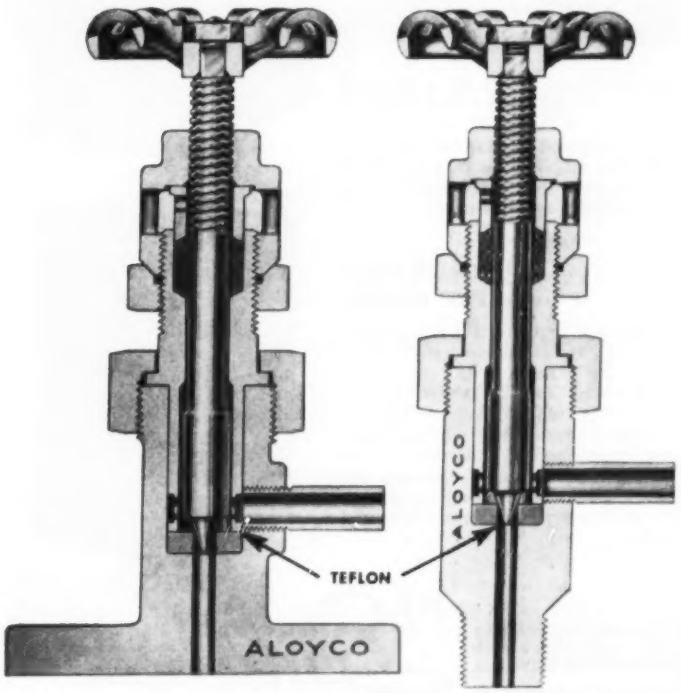
Teflon is a new material with exceptional properties of toughness, heat resistance and corrosion resistance. It withstands the attack of practically all chemicals at temperatures up to 500° F, and has given leak-free performance for over four years of continuous service in valves handling hot sulphuric acid.

Teflon packing is available in all ALOYCO valves. Teflon renewable seats are available in small valves such as those illustrated and in larger size globe, angle, Y, and check valves. Address your specific corrosion problems to the *Aloyco Corrosion Engineering Service*. Our long and specialized experience in this field is at your service.

3.9



No. 62 Needle Valve, 3000 lb. working pressure, made in sizes ¼ inch through 1 inch. Available in 18-8S (type-304), 18-8SMo (type-316) and Aloyco 20.



SAMPLING VALVES

No. 731—flanged end
150 pound service

No. 732—screwed end
300 pound service

ALLOY STEEL PRODUCTS COMPANY, INC.

1322 West Elizabeth Avenue, Linden, New Jersey

Plants: Linden, N. J.; Bloomfield, N. J.; Elizabeth, N. J.

DISTRICT OFFICES:

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LOS ANGELES 22, CALIF.
5442 Jillson St.

"...B'ilers have it over sails"

1853 1953

At the age of 23, Cornelius Vanderbilt made what became a $100 million decision. "B'ilers have it over sails," he told his wife, and scrapped his sailing ferries for steam boats. The "b'ilers" prospered over competition and his fleet became so large that Vanderbilt was popularly known as "Commodore."

From shipping, it was a short step to his fabulous success in railroad transportation.

To Vanderbilt, the boiler was allied to comfort — upper-most in his mind when one of the first H. B. Smith & Company boilers was installed in his Washington Place mansion. The contract provided for additional boiler sections, if necessary, to increase the capacity to that required for adequate heat. But although scientific methods for calculating the boiler size had not yet been devised, the original installation performed satisfactorily.

Today, Smith boilers are installed according to specific installation requirements based on scientific rating methods pioneered by the Company. But the feature which attracted the Commodore is still available to owners of Smith-Mills boilers: as building expansion is undertaken, extra boiler sections may be added to provide adequate heat and hot water.

"Always the BEST BOILER ... Now the BEST BUY!"

Thousands of top flight installations have convinced heating engineers and contractors of the outstanding advantages of the H. B. Smith "200" and "250" series cast iron boilers.

Now . . . their modest initial cost — plus major improvements in these lines — have made them literally "the best buy" for the larger homes and smaller commercial buildings.

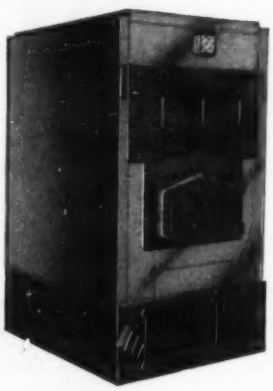
Of prime importance is the fact that the domestic hot water heating capacity has been increased. Built-in tankless or tank type heaters now provide the largest continuous hot water supply of any boilers of equivalent capacities.

Now, more than ever, owners will benefit by "the best buy" with the installation of a Smith-Mills "200" or "250" cast iron boiler.

SMITH-MILLS "200" BOILERS

With net steam I=B=R ratings of from 675 to 1275 sq. ft., the "200" is far and away the most practical heating plant for homes and small business buildings. Convertible to the use of fuels other than oil; built-in-tank or tankless domestic hot water heaters of high capacity are optional equipment. Now supplied in the new Anniversary Hammertone Blue steel jacket.

SPECIFICALLY for larger homes with two or more baths and water-consuming appliances is the "2000" Boiler-Burner unit. Splendid for small business buildings, too. Built-in tankless hot water heaters with capacities to eight gallons per minute are available.



SMITH-MILLS "250" BOILERS

Commercial or public buildings particularly benefit through the installation of the "250" unit. With net steam I=B=R ratings from 1300 to 2275 sq. ft., the "250" is the logical recommendation for present needs or for future heating requirements. Built-in-tank or tankless high-capacity domestic hot water heaters are optional equipment. In Anniversary Hammertone Blue steel jacket.

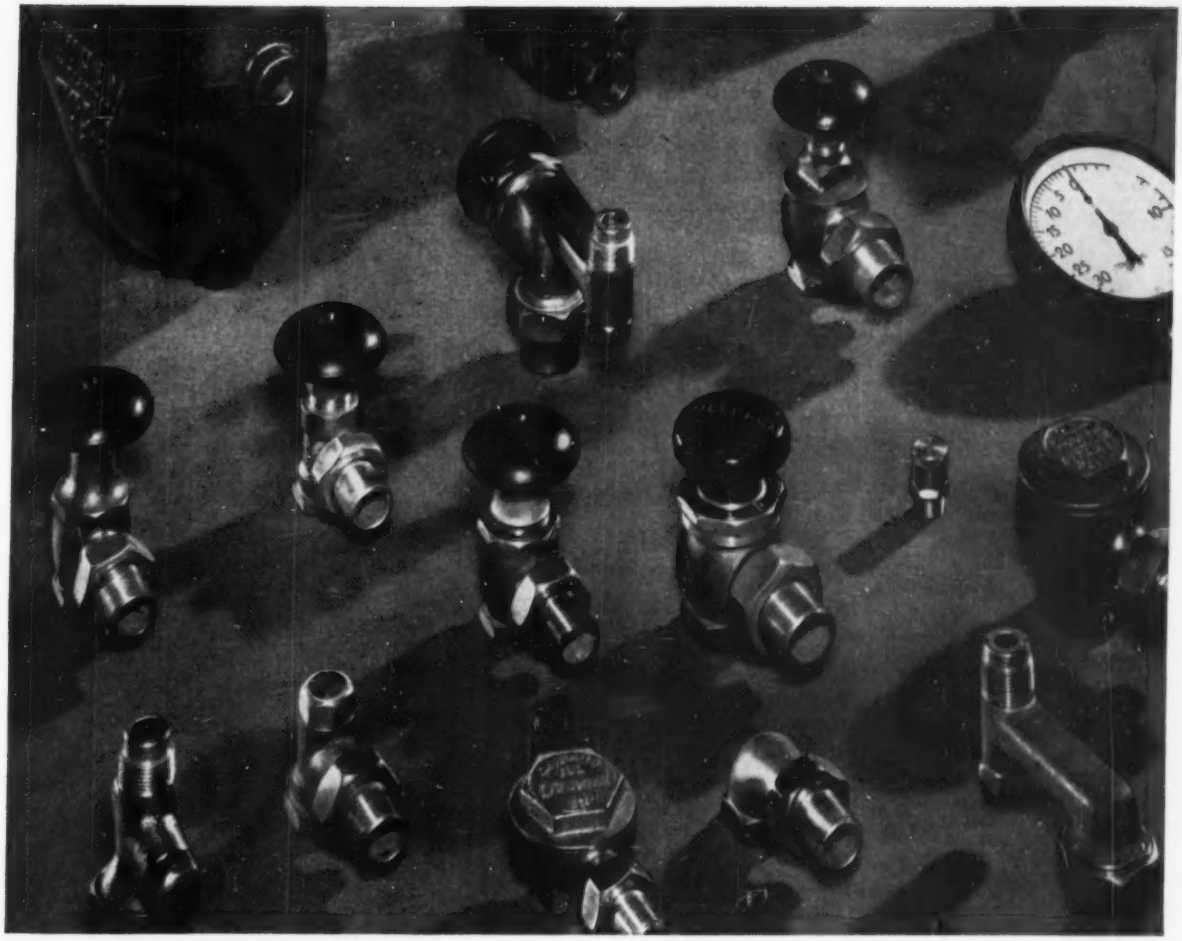
A CENTURY IN '53

OUR YEAR OF GREATEST PROGRESS

H.B. Smith

CAST IRON BOILERS

Established 1853 THE H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS



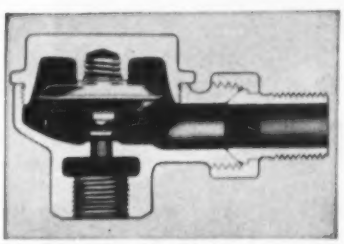
IT'S PROBABLY RIGHT ON THIS PAGE...

Every Steam Heating Specialty You Need is probably in the Dunham line, represented in the photo above. After all, Dunham's Specialties line is as complete as you'll find . . . *anywhere.* Every item has design features that mean better heating performance.

Dunham Radiator Traps, for instance, have an extra large, non-clogging valve seat opening—not restricted by a guide—that assures easy passage of air, water, foreign matter. Dunham's monel metal thermostatic disc has stop shoulder construction for easy individual calibration when servicing traps in the field, also allows thermostatic disc to be set at the factory to assure correct operation without field adjustments.

Sealed under high vacuum, Dunham's thermostatic disc assures positive response to temperature and pressure changes . . . *no bellows to clog or stick.* Disc corrugations distribute motion uniformly with minimum strain, no vibration.

For all the facts about Dunham Radiator Traps and other Heating Specialties, clip and mail the coupon.



Dunham No. 1E Radiator Trap in 3 sizes; 6 patterns; capacities from 200 to 700 EDR.

DUNHAM **HEATING SPECIALTIES**

RADIATION • UNIT HEATERS • PUMPS • SPECIALTIES

QUALITY FIRST FOR FIFTY YEARS

C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON

C. A. DUNHAM COMPANY
Dept. HPAC-12, 400 W. Madison St.
Chicago 6, Illinois

Send Heating Specialties Literature.

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TRI-FLEX and AEROVANE REGISTERS

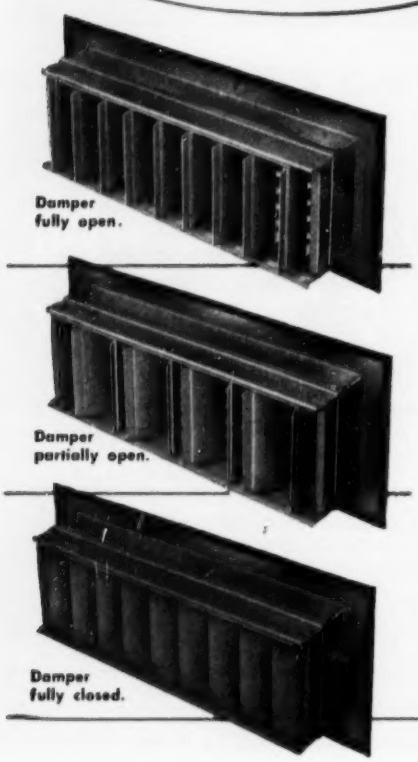
equipped with

Opposed Blade Dampers

Showing TRI-FLEX T-647 Double Deflection Register with Opposed Blade Damper

KEY OPERATOR FOR OPPOSED BLADE DAMPER

Blades are regulated by key operator which may be removed or tapped permanently into place.



Damper fully open.

Damper partially open.

Damper fully closed.

TRI-FLEX Supply Air Registers and AEROVANE Return Air Registers — specified and installed on important air conditioning jobs — are now constructed with opposed blade dampers.

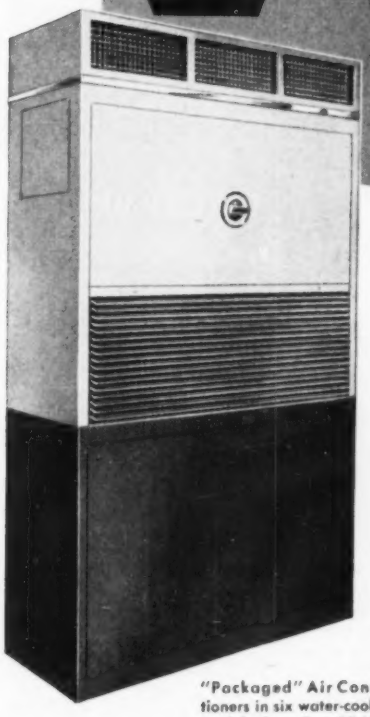
This improved damper unit insures uniform distribution of air over the entire face of the register . . . and provides positive damper setting in any position from fully open to fully closed regardless of system pressure. Set in a rigid steel frame, blades are formed for extra strength and stiffness, and overlap when closed, eliminating any possibility of air leakage. Blades are regulated through the face of the register by means of a key operator which may be removed or tapped permanently into place.

For complete information and size selection data for TRI-FLEX and AEROVANE Registers and Grilles, write for a copy of Catalog No. 200.

TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

7 features that make CHRYSLER AIRTEMP easier to sell...



"Packaged" Air Conditioners in six water-cooled models, from 2 to 15 H.P.

make more money for you, too!

SUPERIOR PRODUCTS — Super-quiet sealed radial compressor, "Maxi-Fin" Coil which increases cooling efficiency, "Air-Foil" Grille with individually adjustable vanes to direct cool air wherever wanted, and other exclusive developments of Chrysler Airtemp engineering make Chrysler Airtemp "Packaged" Air Conditioners the best you can install today.

EXPERIENCE — Chrysler Airtemp pioneered "packaged" air conditioning in 1937—has sold more units than anybody else—offers time-tested products that give continuous satisfaction.

PRESTIGE — People know and respect the Chrysler Airtemp name—have confidence in the products which carry it.

COMPLETE LINE — Six water-cooled models and three air-cooled models can answer practically any cooling requirement.

NO WATER NEEDED — Chrysler Airtemp Air-Cooled "Packaged" Air Conditioners use no water—make air conditioning practical in locations where problems of water supply would otherwise rule it out. Air-cooled models require no plumbing.

LOWER INSTALLATION COST — Super-quiet operation of all models permits their use right in or very close to areas to be cooled, thus reducing the amount of ductwork required.

MORE SELLING HELPS — Extensive national advertising and specialized benefit advertising to individual businesses—the best markets for air conditioning, continuously increases the preference for Chrysler Airtemp "Packaged" Air Conditioning. And, as a Chrysler Airtemp Dealer, you have your choice of the broadest line of tested and proved *local* selling helps in the entire industry.

Fill out and return convenient coupon today for complete facts of your opportunity to make more money selling the "Packaged" Air Conditioning which most people buy—Chrysler Airtemp.

New "Packaged" Air-Cooled Air Conditioners—*no water needed*, no plumbing required. 2, 3 and 5 H.P.

Guaranteed by Good Housekeeping

Chrysler Airtemp

HEATING • AIR CONDITIONING
for HOMES, BUSINESS, INDUSTRY
Airtemp Division of Chrysler Corporation
Dayton 1, Ohio

Airtemp Division of Chrysler Corporation HPA&AC 12-53
P.O. Box 1037, Dayton 1, Ohio

I would like to know more about the Chrysler Airtemp proposition.

Name _____

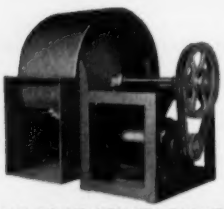
Address _____

City _____ Zone _____ State _____

the Wholesaler is your friend and ours

DIRECT DRIVE

Here's a direct drive blower that you can install and forget. It's rugged and will take years of uninterrupted service. Used for general ventilation and exhaust, the housings are constructed for all conditions. Motors are available for all types of current.

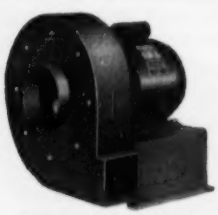


BELT DRIVE UTILITY BLOWER

Arc-welded housings and frames. Housings are convertible for various exhaust angles. Motor pulley adjustable for various speeds.

PVB EXHAUST FAN

For factories, warehouses, etc. Ruggedly constructed for continuous duty. Horizontally or vertically mounted.



PRESSURE BLOWER

For exhaust removal of dust, grit or high pressure conveying or cooling. Blades are balanced and self-cleaning. Bases and housings for heavy duty.

BLOWER-FILTER PACKAGE UNIT

Clock or counterclockwise rotation — easily adapted to ventilation and exhaust systems. Motors and drives available.

PEERLESS HELPS WHOLESALERS GIVE YOU ENGINEERING SERVICE AND PERSONAL CONTACT ON *Middle-Size Jobs*

PEERLESS has built a national network of wholesalers who serve engineers and dealer-contractors almost everywhere. These wholesalers not only have the most complete line of fans and blowers for the middle-size jobs but Peerless has also specialized in producing top-performing products for them.

The Peerless Wholesaler has quick contact with the factory for engineering data and delivery information without red tape delay. He has a good inventory from which he can serve you and competitive prices to go with it.

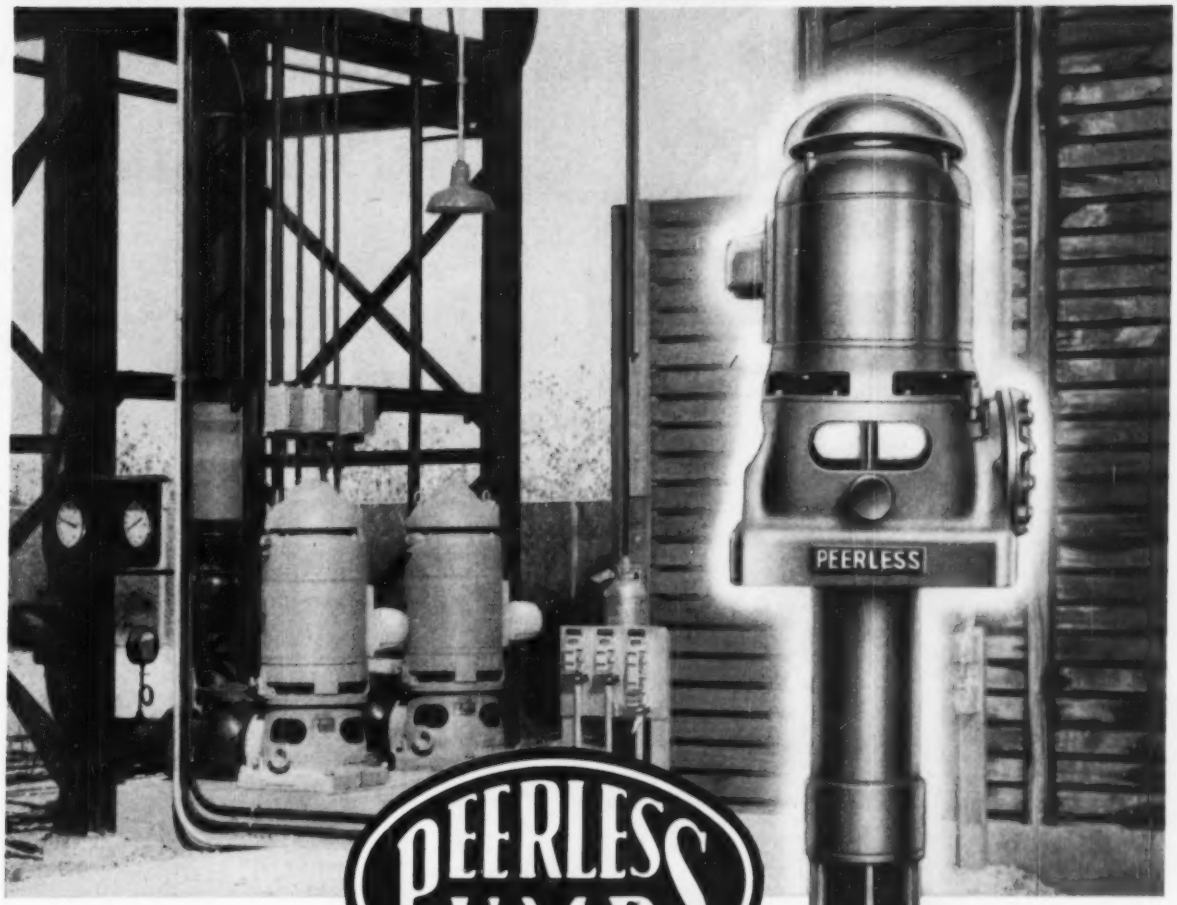
It will pay you well to know the Peerless wholesaler in your community, so write, wire or phone for his name.

"SMOOTHEST PERFORMERS ON THE MARKET"

Peerless Electric

FAN AND BLOWER DIVISION
THE PEERLESS ELECTRIC COMPANY
1409 WEST MARKET ST. • WARREN, OHIO

PEERLESS CLOSE-COUPLED PUMPS



PEERLESS PUMPS

Here's why

YOU CAN PROFITABLY APPLY *Peerless* VERTICAL PUMPS TO COOLING TOWERS

1 *YOU ELIMINATE SUCTION PIPING* **2** *YOU ELIMINATE PRIMING PROBLEMS* **3** *YOU SAVE INSTALLATION SPACE*

Not only is the Peerless vertical design a definite space saver over other pump types but it eliminates much of your piping and fitting costs and once primed, this vertical turbine pump is always primed; fear of running the pump dry is no hazard here. A vertical close-coupled pump is also best suited to adaptation to future system demands. Furthermore, it's the easiest of all pumps to service, maintain and adapt. NPSH required for operation may be adjusted to available NPSH in most installations because of the flexibility of this vertical design. A minimum of submergence is required for operation. Peerless field engineering service on vertical cooling tower pump designs is nation wide. Consult with the Peerless sales office or distributor nearest you. They can be of help in cooling tower sump design as well as pump and driver selection to obtain the most efficient and trouble-free cooling tower pumps. Or mail the coupon today for full information.

Capacity: 30 to 30,000 GPM

Head: Widest head range—from minimum to 1000 feet

Impeller: Special hydraulic design for low NPSH

Drives: Standard and explosion proof vertical pump motors. Also vertical and horizontal (right angle) steam turbine and right angle stationary engine drives.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles, Calif. and Indianapolis, Indiana.
Offices: New York; Atlanta; Chicago; St. Louis; Phoenix; Fresno; Los Angeles; Tulsa; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.
Distributors in Principal Cities; Consult your Telephone Directory.

PEERLESS PUMP fmc

MAIL COUPON FOR INFORMATION

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Please send complete data on vertical close-coupled pumps for cooling tower service.

NAME_____

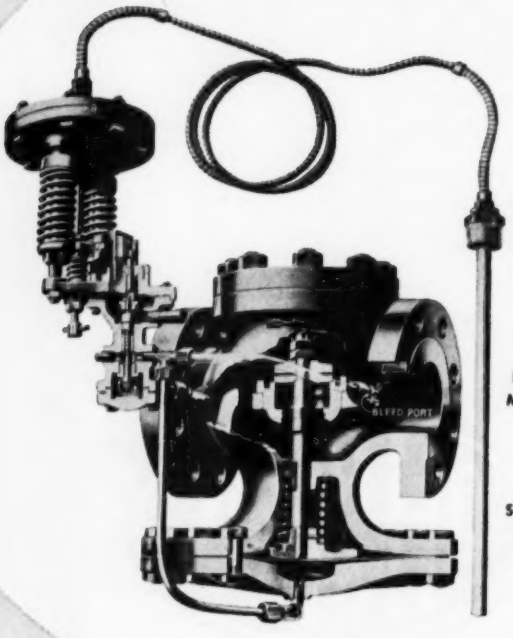
COMPANY_____

ADDRESS_____

CITY_____ STATE_____

HP&AC

3 Reasons for Accurate Regulation



PACKLESS CONSTRUCTION

LARGE BALANCED METAL DIAPHRAGM

SENSITIVE PILOT

Spence

Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

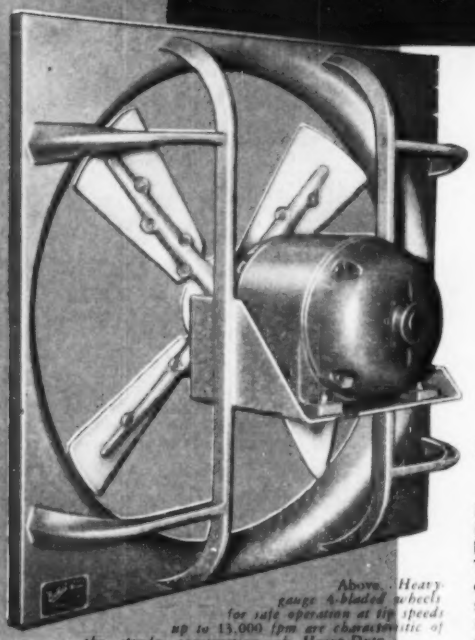
These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

SPENCE ENGINEERING COMPANY, INC., Walden, New York

BUILT TO HANDLE MORE JOBS BETTER!

These Husky New "Buffalo" DISK FANS



Above, Heavy gauge 4-bladed wheels for safe operation at tip speeds up to 13,000 fpm are characteristic of the sturdy construction of Heavy-Duty "NV" Propeller Fans.

- Many sizes, to 90,000 cfm!
- Free Air or pressures to 1"!
- Easily installed "packages"!

With the development of this improved and broadened line of "Buffalo" Propeller Fans. It is now possible to handle many additional ventilating and exhausting jobs with these fans at lower first cost and lower cost installation.

The HEAVY-DUTY TYPE "NV"

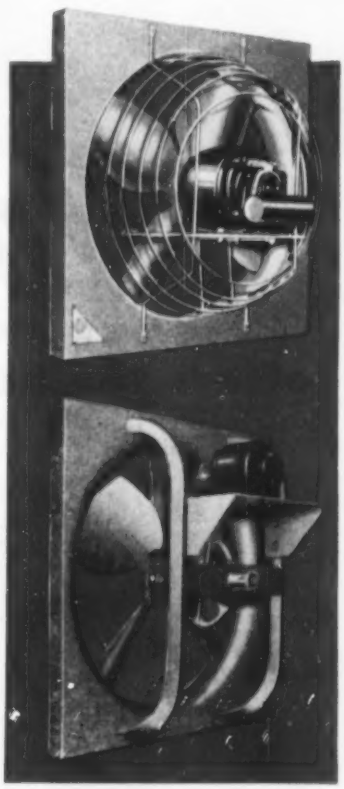
Above, is built in 24", 30", 36", 42", 48" and 54" sizes, direct or v-belt drive, for free air delivery or against system resistances as high as 1". Fans may be had with special protective coatings, stainless steel wheels, hard aluminum, Non-Sparking Everdur wheels for handling fumes with moisture, acids, alkalis and various gases. Models for high or low ambient temperatures are available. WRITE FOR BULLETIN F3790.

NV-BREEZO "Diamond Jubilee" Fans

Rugged, attractive and eye-appealing, this fan has a steep pressure characteristic combined with efficient free-air performance! Thus, you can get stable, efficient and high capacity performance from this fan in simple wall installations or ventilating systems with ¼" to ½" s.p. The rigid, welded motor-side wire guard is also a firm motor support. May be had in protective coatings, Stainless Steel, #3S Aluminum or Everdur brass for corrosive and/or explosion-proof applications. 8" to 24" sizes. WRITE FOR BULLETIN 3865.

The 24", 30" & 36" BELT-AIR is a top performer from any angle!

Its new sleeve bearing on the fan shaft permits fan operation at any angle from vertical to horizontal, shaft up, and provides quieter vertical shaft operation than ball bearings. Other major design changes provide higher capacities at lower, quieter speeds, and lower power consumption, also as a lay-down unit with motor and bearing assembly on discharge side. Also new Belt-airs available in larger sizes 42" thru 84". This line effectively covers ranges from 5000 to 90,000 cfm. One of the units on this page may be just the economical, satisfactory fan you're looking for — WRITE FOR ENGINEERING DATA NOW!



"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

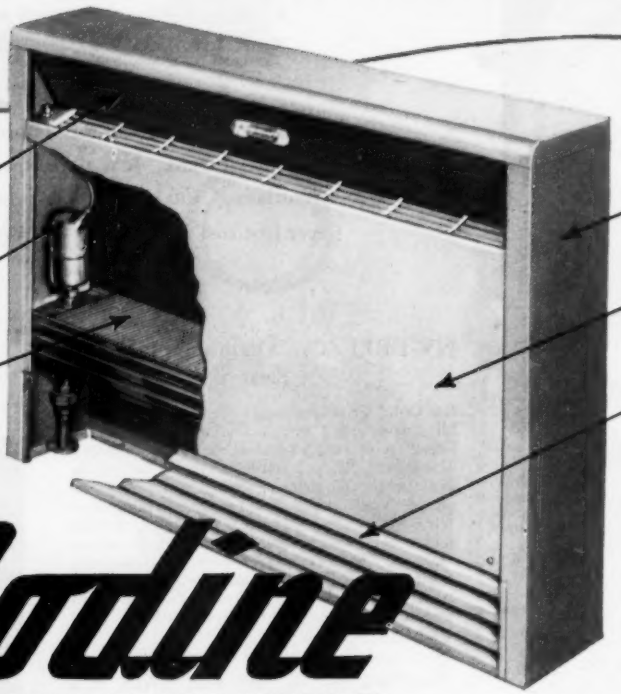
171 MORTIMER ST. BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING · AIR CLEANING · AIR TEMPERING · INDUCED DRAFT · EXHAUSTING
FORCED DRAFT · COOLING · HEATING · PRESSURE BLOWING

Plan your heating for the life of the building



Unique damper, for finger-tip temperature control, conceals curved outlet air grille.

Air vent can be conveniently located at either end of outlet grille—instantly accessible.

All steam-carrying passages are copper or copper alloy . . . brazed for pressure-resisting strength.

Steel enclosure is Bonderized for rust protection, built to "take it."

Front panel is quickly removed and replaced by means of two screws for full access to unit.

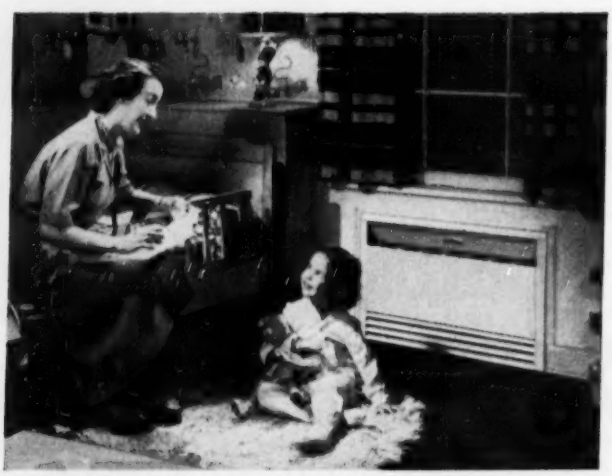
Attractive lower grille (optional) snaps in or out, conceals piping.

Popular Type F illustrated. For exposed or recessed installation. Immediately available from most jobbers' stocks.

Modine

CONVECTOR RADIATION

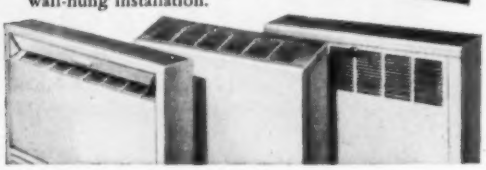
offers the best in long-life, economical service

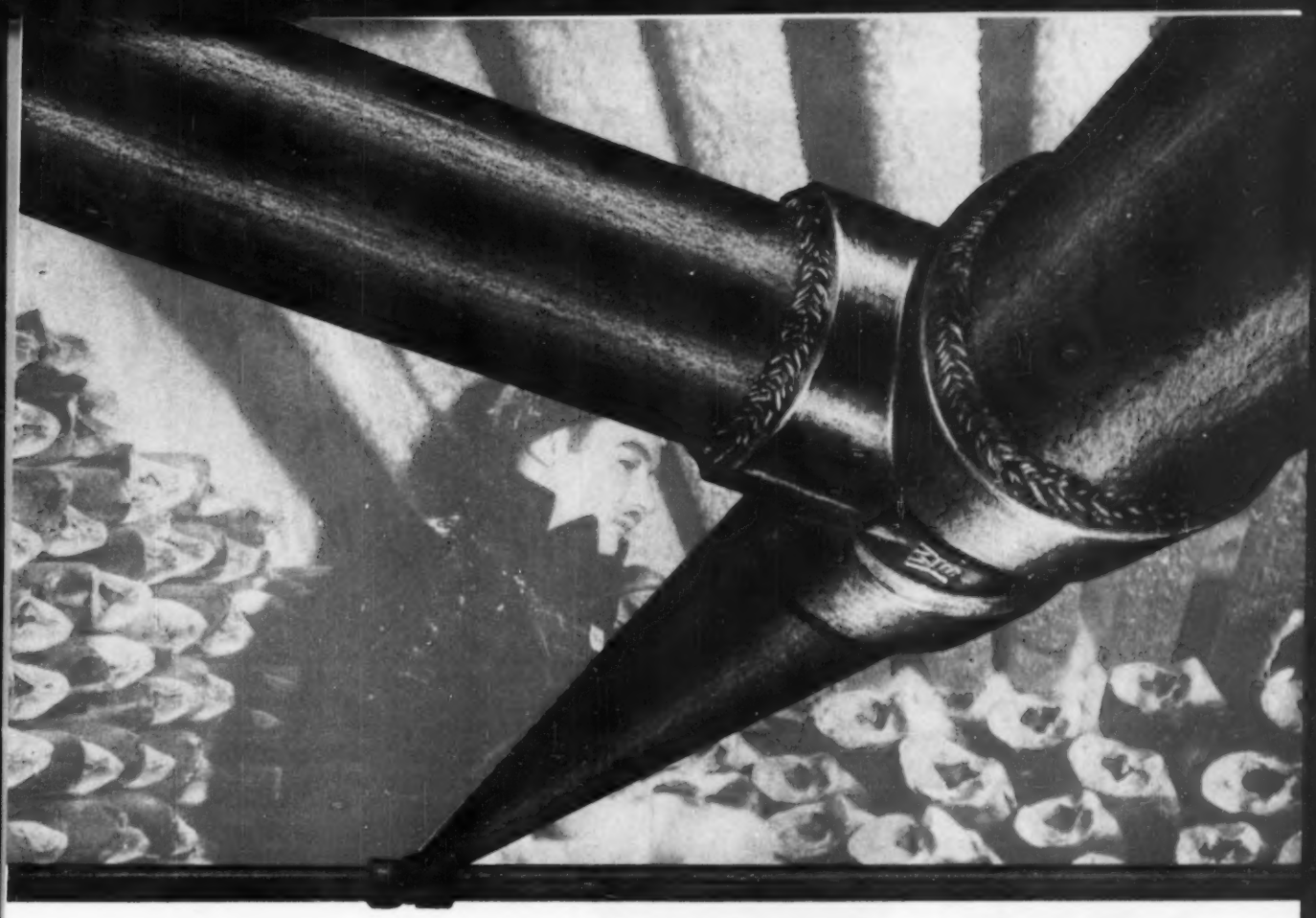


Simplicity of styling complements the beauty of both modern and traditional design, also promotes ease of cleaning.

DON'T sacrifice quality on built-in permanent heating equipment. To get the finest in modern, long-life heating . . . at lower over-all costs—follow the lead of top architects and heating engineers. Choose Modine Convector Radiation. It's your assurance of many years of heating system satisfaction. For complete information, see the Modine representative listed in your classified phone book. Or for your copy of Bulletin 251, write Modine Mfg. Co., 1509 DeKoven Avenue, Racine, Wisconsin

Choose from three enclosure types in standard and heavy-duty institutional models for free-standing, recessed or wall-hung installation.





Forged to Fit Refrigeration Problems . . .

WATSON-STILLMAN SOCKET-WELDING FITTINGS

Have you discovered the economy and low maintenance cost of an all-welded piping system? If so, you are already in line for still further advantages from this type of system when you start specifying Watson-Stillman Double-diamond FORGED STEEL SOCKET-WELDING FITTINGS.

Made on special machines from solid forgings whose material is selected for good weldability and in strict accordance with the required specifications.

W-S Fittings give you joints stronger than the pipe itself. Deep sockets, ease alignment, provide ample come and go for pipe sections, minimize field cutting and assembly problems.

Design of fitting is such that flow is smooth and uninterrupted by "icicles" or turbulence at the joint. Available in carbon, stainless and chrome-moly alloy steels.

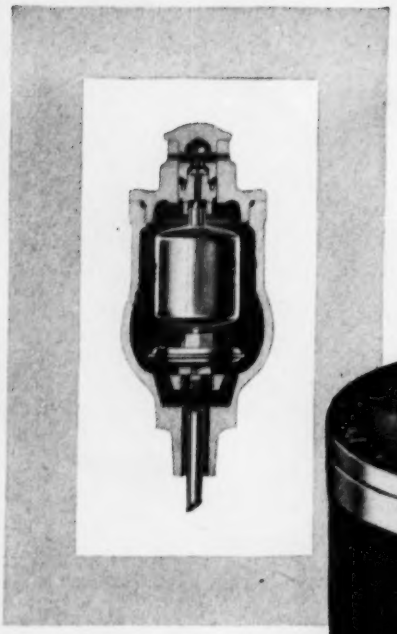
For those applications where screw-end fittings are indicated, you can get the same superior physical and chemical qualities in the steel analyses you want by specifying W-S FORGED STEEL SCREW-END FITTINGS. Look for the double-diamond trademark. Write for literature.

SOLD THROUGH LEADING DISTRIBUTORS

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

132 ALDENE RD., ROSELLE, NEW JERSEY



A well placed air vent can work a heating miracle!

No. 5 Rapid Vent. Float and thermostatic construction. Designed for use at the end of steam mains, tops of risers and other similar locations on vapor and one pipe vacuum systems where the maximum venting requirement does not exceed one cubic foot per minute at 5 psi.

No. 6 Quick Vent. Thermostatic only. Designed for installation at high points in the piping where there is not sufficient room for the No. 5 Vent or where a float is not needed. Same venting capacity as No. 5.

No. 50 Air Vent. Float only. Designed to remove air and gases automatically from hot or cold water tanks, coils or piping, liquid pump systems or similar applications where it is necessary to vent air rapidly. Maximum working pressure, 125 psi.

No. 55 Air Vent. Float and thermostatic construction. Is capable of expelling large volumes of air without passage of water or steam and is designed for use on steam pressure vessels or systems. Maximum working pressure, 125 psi.

No. 7 Air Eliminator. Float and thermostatic construction. Expecially suitable for installation at the ends of steam mains, return piping and tops of risers where it is necessary to expel a large volume of air from the system. Suitable for working pressures up to 15 psi.

In a Wilmette Illinois Building, an outwardly well-engineered vacuum system had been a headache for years. Then, last winter, along came a heating man who quickly sized up the situation and said with real conviction: "Put a Marsh No. 5 Vent right there!"

That did it! One inexpensive vent cleaned up a spotty, erratic condition, that a number of expensive alterations had failed to touch.

Unusual? Not in the least: over the years we have seen a lot of wonders worked by installing the right kind of Marsh air vent in the right spot. A number of these dependable vents are illustrated here . . . products that express an unrivaled accumulation of knowledge in dealing with air venting problems.

Marsh air vents are fully covered by the Marsh Heating Specialty Catalog along with Marsh Traps and Valves. Your local Marsh man will be glad to work with you in applying Marsh Vents effectively.

MARSH HEATING EQUIPMENT CO.

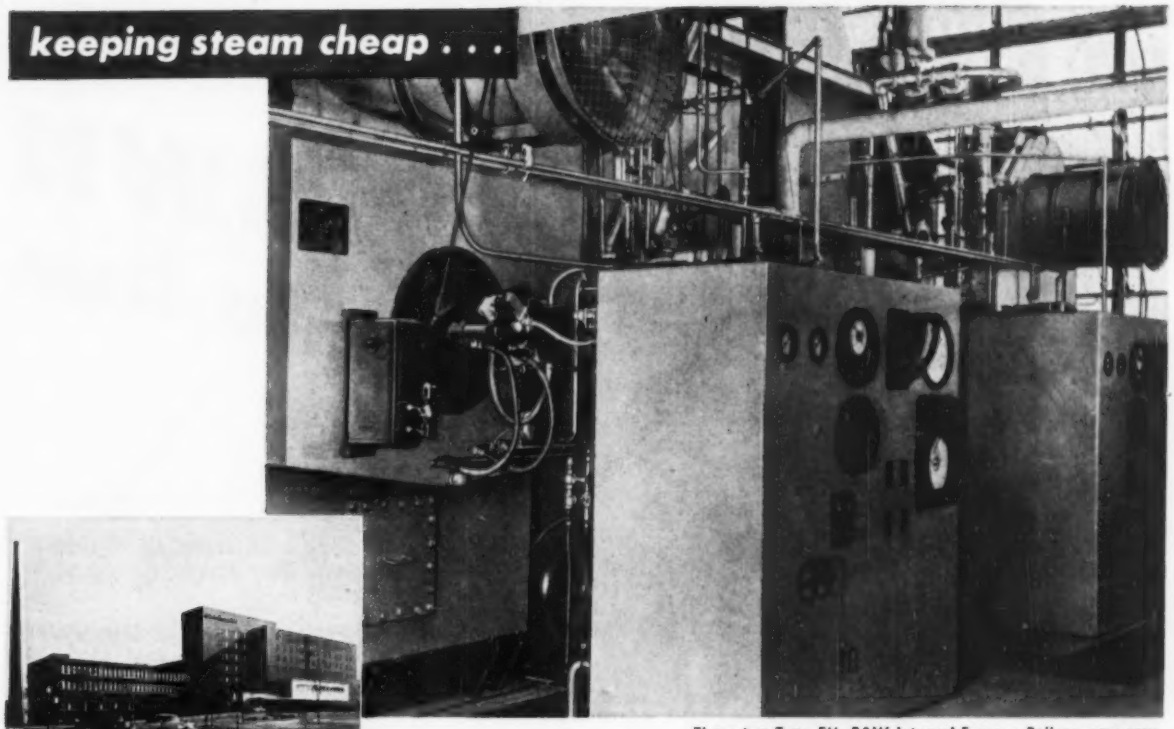
Sales Affiliate of Jas. P. Marsh Corporation

Dept. T, Skokie, Ill.

MARSH

Quality Heating Specialties since 1865

keeping steam cheap . . .



Designed by Albert Kahn Associated Architects and Engineers, Detroit.

These two Type FM, B&W Integral-Furnace Boilers, now serving the completed hospital, will eventually provide steam for most of the buildings in the planned medical center.

Detroit's New SINAI HOSPITAL

Chooses B&W Type FM Boilers

Recently opened, the 211-bed Sinai Hospital—affiliated with the Jewish Hospital Association of Detroit—is the first completed unit of a projected, modern medical center which will eventually include outpatient facilities, a school of nursing and dormitory, convalescent building, physicians' building, and additional patients' wings.

To assure efficient, economical steam generation, and to speed and simplify construction of the hospital's plant, two B&W Integral-Furnace Boilers, Type FM, were installed and are currently supplying steam for heating, laundry, cafeteria, kitchen, and other service requirements. Chosen instead of larger units which would have required costly field erection and close operating supervision, the compact, shop-assembled, oil-fired Type FM Boilers—each having a steam capacity of 15,000 lb per hr—were delivered "ready-to-go", complete with firing equipment and controls . . . required nothing more than skidding into position and hooking up of service connections.

Selected with future requirements also in mind, the two B&W FM units will serve most of the planned structures. A third boiler will be added as the project nears completion. At present, one unit is sufficient to meet all normal loads, so the two boilers are used alternately. The FM units are being operated at 100 psi for laundry requirements, while a system of valves reduces the generated steam to 2, 5, and 50 psi and regulates it for various services in the boiler room as well as other parts of the hospital.

Detroit's new Sinai Hospital is typical of hospitals in various parts of the country which have found the type FM Boiler ideal for their requirements.

This popular B&W unit is suitable for a wide range of industrial, commercial, institutional, and other classifications . . . is available in standard sizes for loads ranging from 2900 to 28000 lb of steam per hr, at pressures to 235 psi . . . is already in service or on order for a total steam capacity of nearly 7,000,000 lb per hr.

COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

For a detailed, illustrated description of how the cost-saving features of this B & W unit can benefit you, write for Bulletin G-76A. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

BOILER DIVISION

G-625

ALLIS-CHALMERS

Air Conditioning PUMPS

BOLT THEM DOWN ...They're Ready to Run

Bulletin 52B7529

FHP Pump

Up to 80 gpm, heads to 140 feet

This compact pump and motor needs only two bolts for installation. Rigid construction holds alignment for longer bearing and seal life. Mechanical seal. Open impeller economy model does adequate job on many installations at very low cost. Also available as frame-type pump for separate mounting.

Any of the three Allis-Chalmers pumps shown here will save time on your air conditioning jobs. To install them, all you do is bolt them down, then make piping and electrical connections.

Fast Delivery. Field stocks speed delivery. A telephone call to your nearby Allis-Chalmers authorized distributor or district office gets immediate action.

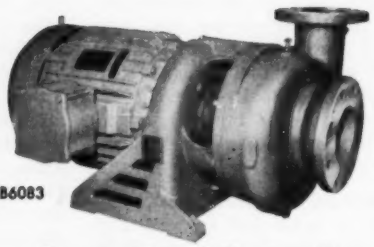
Free Engineering Help. Every Allis-Chalmers pump representative is an application expert. He can give valuable suggestions in planning your equipment and installations. Next time you have a pump problem, call for an Allis-Chalmers representative or write Allis-Chalmers, Milwaukee 1, Wisconsin, for centrifugal pump bulletins 52B7529, 52B6140, and 52B6083 describing air conditioning pumps. A-4204

Bulletin 52B6140

Electrifugal Pump

Up to 500 gpm, heads to 125 feet

Only pump with unit-cast frame. Requires only four bolts for installation. No alignment problems because motor and pump are mounted on a single shaft in a one-piece cast-iron frame. Plenty of space for maintenance. Standard packing or mechanical seal. Also built as frame-type pump for separate mounting.



Bulletin 52B6083

Supporting Adapter Pump

Up to 2500 gpm, heads to 550 feet

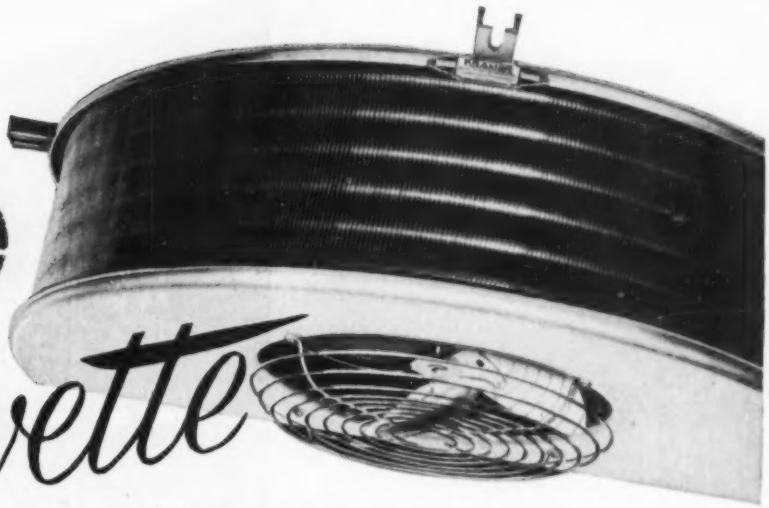
Flange motor and pump mounted on sturdy cast-iron supporting adapter. Motor and pump use same shaft. Only four bolts needed for installation. Rigidity assures vibrationless operation and long bearing life. Standard packing or mechanical seal. Built in same ratings as frame-type pump for separate mounting.

Electrifugal is an Allis-Chalmers trademark

ALLIS-CHALMERS

Large Curvette

by KRAMER



HINGED PAN

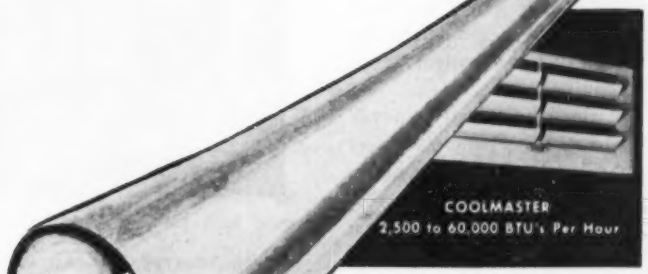
quick and *easy* access

Praised for years by installation and service men.

Built-in Heat Exchanger

NO RUSTING — polished aluminum casing

SMALL CURVETTE
800 to 5,600 BTU's Per Hour



COOLMASTER
2,500 to 60,000 BTU's Per Hour

RADIAL
2,500 to 23,000 BTU's Per Hour

KAY-TEE
2,500 to 12,000 BTU's Per Hour

WRITE NOW FOR BULLETIN C-192-7

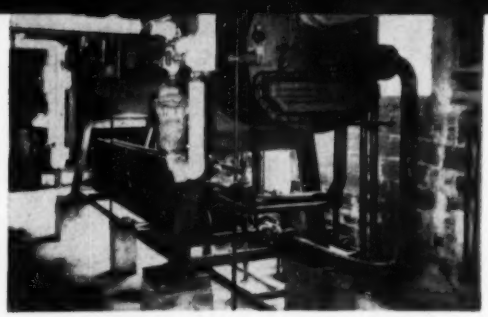
KRAMER TRENTON CO. • Trenton 5, N.J.

Modern living and year-round comfort for tenants is the theme at the new Paces Ferry Tower Apartments in Atlanta, Georgia. This apartment hotel, one of the finest and most modern in the Atlanta area, contains 202 completely air-conditioned living units, in addition to convenient shops and a restaurant located on the first floor.

In every phase of design and construction, all materials were selected with extra care. That's why Spang CW Steel Pipe was used exclusively in the air conditioning system. And there's a good reason. The steel for manufacturing Spang CW Steel Pipe is carefully selected for special characteristics . . . strict metallurgical control is maintained during forming . . . and the finished pipe is thoroughly inspected to assure you of a perfect product.

This explains why Spang CW Steel Pipe is just right for easy forming, welding, cutting, bending, and threading . . . features that speed installation and reduce costs for you.

Don't take pipe that will "just do" . . . insist on Quality Controlled Spang CW Steel Pipe. Ask your distributor, he'll tell you why Spang is the best.



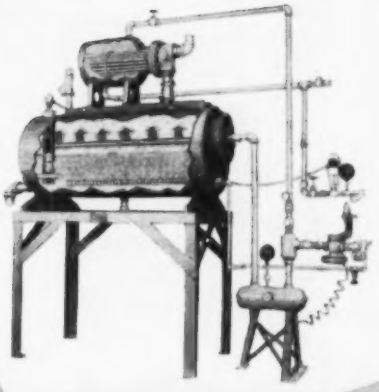
Owner: Paces Ferry Tower, Inc., Atlanta, Georgia
Architect: J. C. Wise, Atlanta, Georgia
General Contractor: Mion Construction Co., Atlanta, Georgia
Piping Contractor: Stephenson Company, Inc., Atlanta, Georgia
Distributor: Cowan Supply Co., Atlanta, Georgia

SPANG

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Office: Two Gateway Center, Pittsburgh, Pennsylvania. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

a Fresh approach . . . a Major advance . . .

in boiler feedwater deaeration



SCHAUB ZERO-OXYGEN Deaerators

NEW DESIGN! NEW PERFORMANCE! NEW SAVINGS!

Complete Oxygen Removal (to .005 cc/liter) • Complete Safety and Dependability • Wide Range for Load Variations • High Thermal Economy • Low Maintenance Costs • Simpler Design for Trouble-Free Service

Start with an idea that's *basically* new and better. Then produce performance beyond the best that ordinary deaerators can deliver. Schaub engineers achieved it . . . developed the all-new deaerator that's a major advance in boiler feedwater deaeration!

Two basic differences give the Schaub Zero-Oxygen Deaerator its outstanding advantages . . . note them well. First, it provides *external* pre-heating to a temperature *above* boiling point, with over-atmospheric pressure held only up to the internal sprayer manifold! Second, a free, non-restricted vent liberates *all* air *immediately* with maximum vapor heat recovery!

From these simple fundamentals stems a whole series of all-important performance benefits. Every engineer or operating man concerned with boiler feedwater deaeration should have the full facts on all-new Schaub Zero-Oxygen Deaerators. Simply send the coupon to get the complete story — promptly.

FRED H. SCHAUB ENGINEERING COMPANY

2116 South Marshall Boulevard • Chicago 23, Illinois

FREE FACTS!
SEND COUPON TODAY
FOR BULLETIN 575

Tells why you need deaeration. Explains basic differences in deaeration systems. Here's the complete story on new Schaub Zero-Oxygen Deaerators.

FRED H. SCHAUB ENGINEERING COMPANY
2116 South Marshall Boulevard, Chicago 23, Illinois

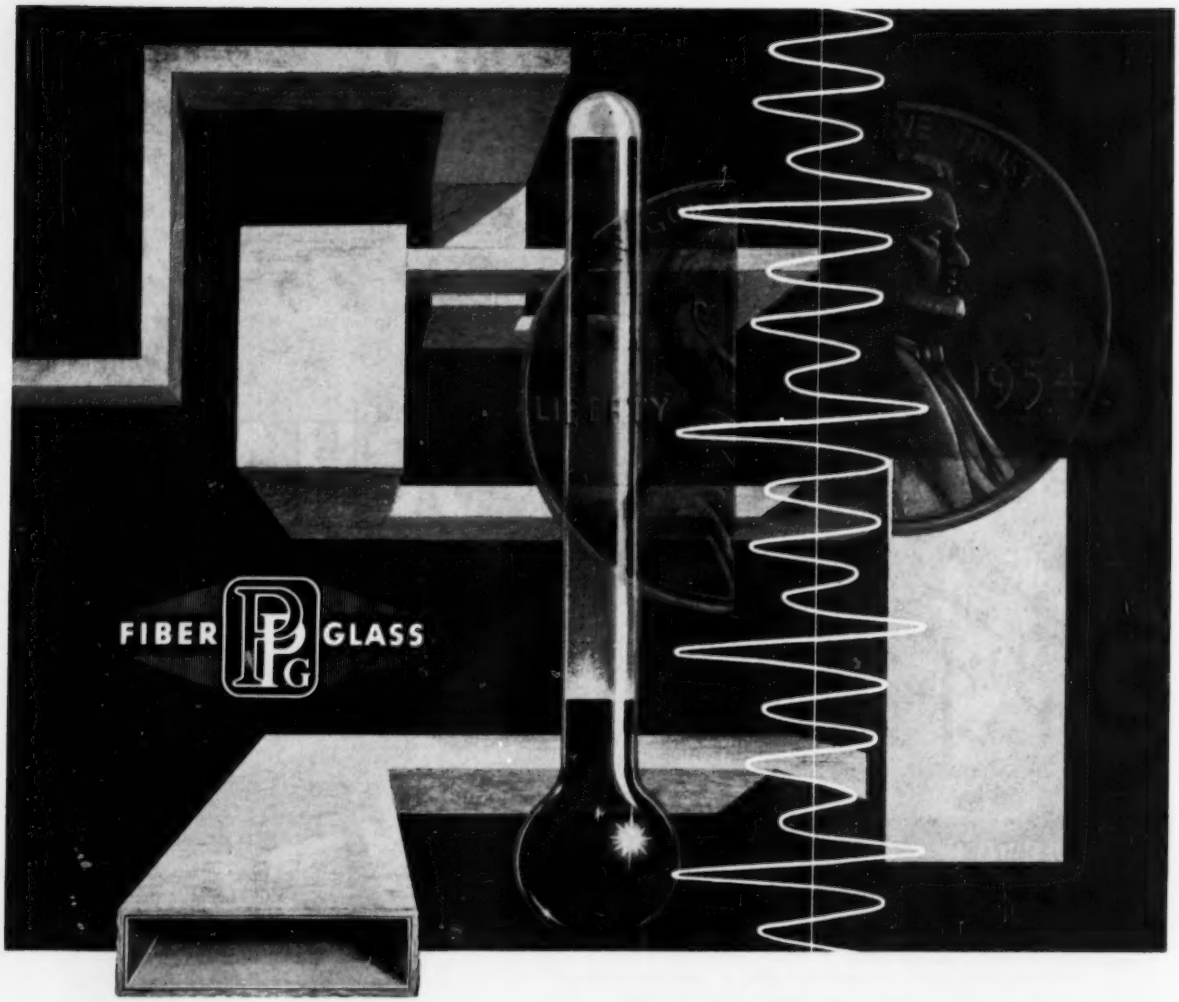
Please send me without cost or obligation, my personal copy of your new bulletin 575 on Boiler Feedwater Deaeration.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____



New economies in plant ductwork insulation— Pittsburgh Superfine Insulation

Pittsburgh Superfine is so extremely lightweight and easy to install that important thermal or acoustical insulation can be added to your plant's ductwork *in minimum time and at lowest cost.*

Made from exceedingly fine fibers, Pittsburgh Superfine offers maximum thermal insulation for both high or low temperature ductwork, as well as excellent sound absorption qualities in the middle and high frequency ranges. In application, it is easily cut to desired sizes with either knife or shears, fitted to all ductwork shapes rapidly. Pittsburgh Superfine can be applied to ductwork by either adhesives, tapes, cord or wire—or covered with canvas, asbestos, paper or vapor barrier.

For complete information on Pittsburgh Superfine for your plant's ductwork, contact our executive offices or district offices in Chicago, Cincinnati, Cleveland, Detroit, New York or Washington, D.C. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.

FIBER GLASS **PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS**

PITTSBURGH PLATE GLASS COMPANY

The fittings that revolutionized pipe welding . . .

In the year 1931 Taylor Forge gave industry its *first real line* of seamless, butt-welding pipe fittings. We say it was the first *real* line because it was the first to include not only long and short radius ells, but also full branch and reducing tees, concentric and eccentric reducers, stub ends, caps and welding neck flanges.

This was a fully planned development. Many years before Taylor Forge had foreseen the future of the butt-welding fitting . . . had realized that pipe welding could not go beyond its then crude stage until pipe users were given *all* the fittings necessary to make up complete piping systems.

So Taylor Forge went to work on this and after long research and development came out with the full line that became the inspiration of modern pipe welding.

Naturally the organization that started ahead has kept ahead . . . in design, in quality, in breadth of line. That is why so many men who have followed the development of the WeldELL line, refuse to consider any other kind of welding fittings.

T F

For up-to-the-minute facts, see your Taylor Forge distributor

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill.
Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

COAL SAVES 30% OVER OIL!

"When we remodeled our Reading power plant, we had two good solid reasons for choosing coal as our fuel.

"First, producing steam with oil would cost us up to 30% more than coal burned the modern way.

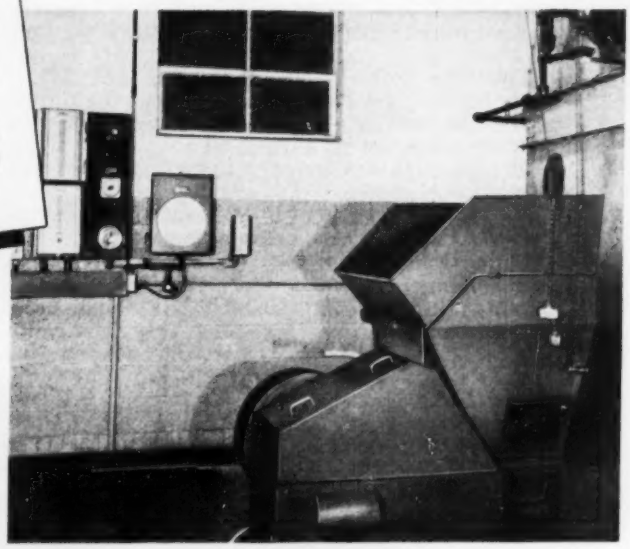
"Secondly, if we burned oil, a mechanical or electrical failure could shut us down tight. With coal, even if our single stoker broke down, we could hand-fire and keep going.

"For dependable low-cost steam, we're convinced this coal-burning installation is our best bet."

Additional case histories, showing how other types of plants have saved money by burning coal the modern way, are available upon request.

"By burning coal instead of oil, we save up to 30% on fuel costs and enjoy trouble-free operation!"

says C. R. Crowther, Vice President
Reading Glazed Paper Corp.
Reading, Pennsylvania



Here's a tip that can save you dollars on steam costs. Equip your plant with a modern coal-burning installation designed to fit your specific needs.

You'll find modern combustion equipment has made coal more economical than ever before. You'll find that up-to-date coal and ash-handling equipment will cut your labor costs and provide you with a clean, convenient, dust-free operation.

And only with coal can you be sure of a plentiful supply of fuel at relatively stable prices—now and far into the future. Coal, unlike other fuels, has virtually inexhaustible reserves. And America's highly mechanized coal mining industry is the most efficient and productive in the world.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association
Southern Building, Washington 5, D. C.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for *hundreds of years to come.*

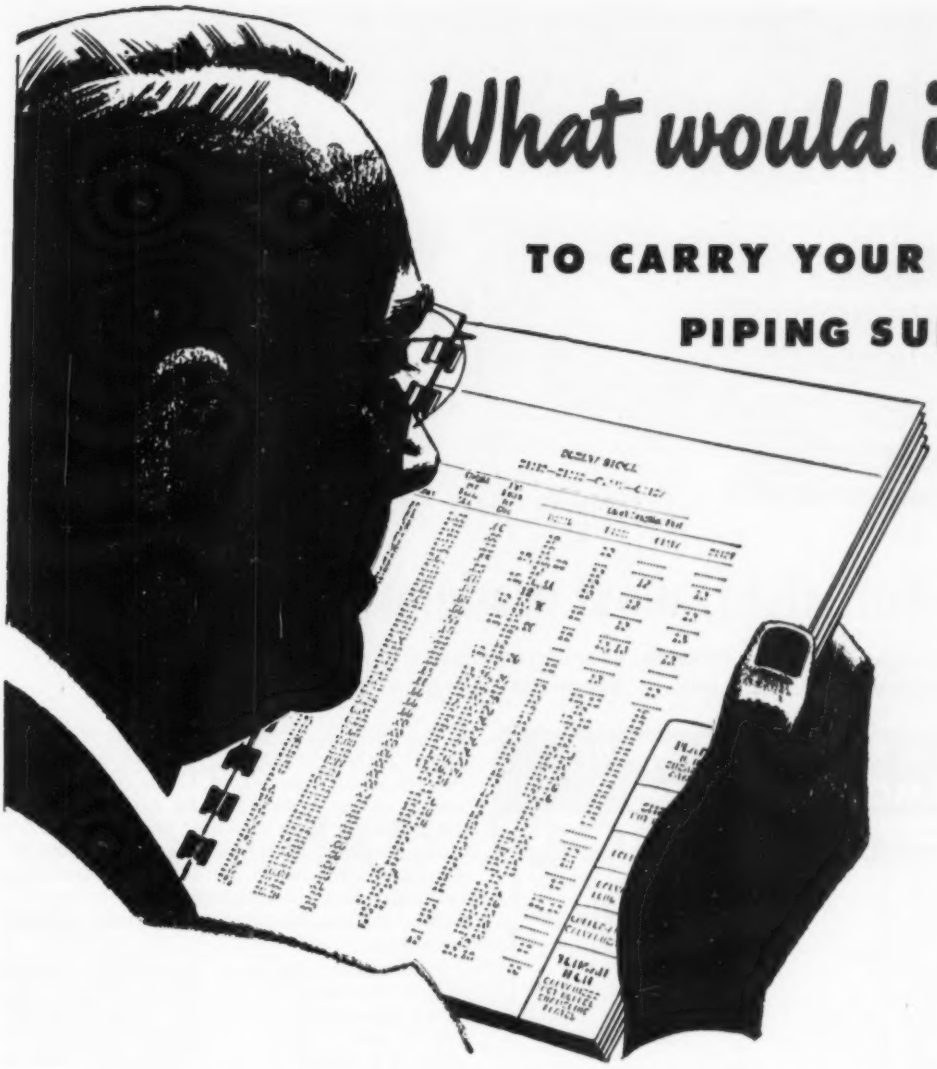
COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

What would it cost

TO CARRY YOUR OWN PIPING SUPPLIES?

● Very briefly, the answer is: "Too Much!"

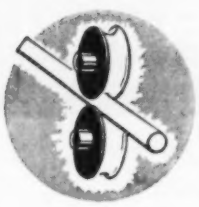
You probably do, and should, carry sufficient supplies for the every-day run of small jobs.

But to carry everything you might need for six, or even three months would freeze a lot of your working capital—would require a lot of warehouse space.

That's why it makes sense to let your Republic Steel Pipe distributor carry your inventory. He carries a full line of steel pipe in all the sizes you need . . . plus the fittings, valves, fixtures, controls, tools . . . everything for a complete plumbing, heating, refrigeration, air conditioning, process and industrial piping, or other piping job.

He delivers in a hurry, whether it's just a few lengths or a truckload. You get just the supplies you need, when you need them. And you save floor space. You save insurance. You save handling costs.

It's profitable to know your Republic Pipe Distributor. A phone call is all it takes to get acquainted.



Easy to bend, thread, and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths

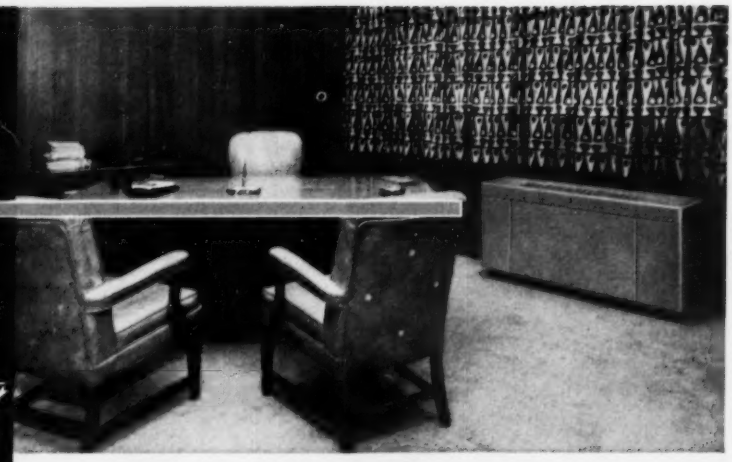
Republic STEEL PIPE

REPUBLIC STEEL

REMOTAIRE

ROOM CONDITIONER

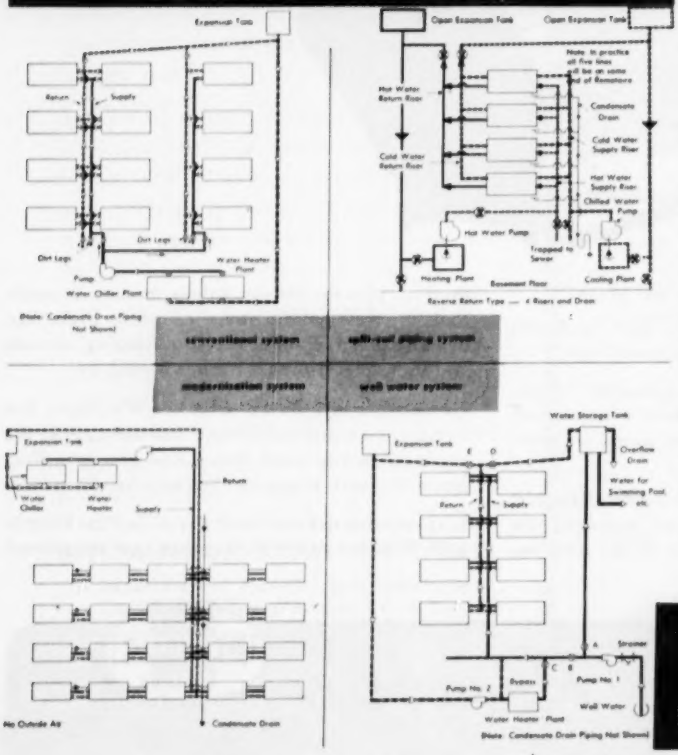
individual-room, remote-type units providing year 'round air conditioning for central plant multi-room installations



Adaptable to the one system that's most efficient, most economical for the job...

WALL APERTURE SYSTEM • INTERIOR VENTILATION SYSTEM • WELL WATER SYSTEM
SPLIT-COIL SYSTEM • MOTEL SYSTEM • RESIDENTIAL SYSTEM • MODERNIZATION SYSTEM

SOME TYPICAL PIPING ARRANGEMENTS FOR REMOTAIRE SYSTEMS:



● The Remotaire room conditioner heats in winter, cools in summer . . . filters and circulates the air all year 'round. Using chilled water from a central water chiller for summer cooling and hot water from a central heating plant for winter comfort, the Remotaire system provides clean, draft-free, healthful comfort-conditioning for multi-room installations such as hotels, motels, schools, hospitals, office buildings and residences.

A Remotaire system is versatile. It can be adapted to the system of air conditioning that is best suited to each building . . . new construction or modernization. Ventilation can be provided in a variety of ways . . . several methods of piping arrangements are possible. Since units can be installed free standing or recessed partially or completely, they afford wide flexibility in architectural planning.

As part of a Remotaire system, individual unit control permits each room occupant to choose the temperature that suits him best without affecting adjoining rooms. And when the unit is not in use it can be completely turned off, thereby reducing operating costs.

For further details on the various Remotaire systems, write for descriptive literature.

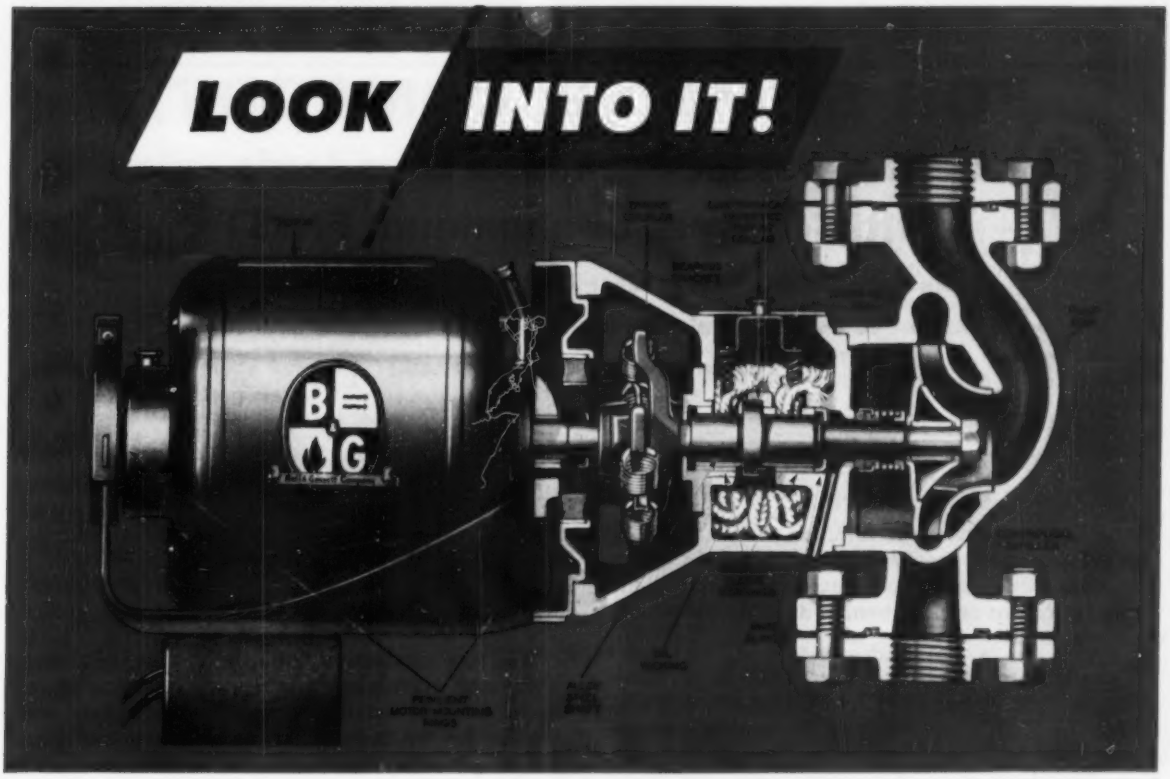
AMERICAN-Standard
AIR CONDITIONING

American Radiator & Standard Sanitary Corporation, Dept. HP-123, Pittsburgh 30, Pa.

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

LOOK INTO IT!



COMPARE THE B&G BOOSTER POINT BY POINT

Smaller, more compact, to meet today's demand for space-saving equipment.

One look is enough to show you why more B & G Boosters are sold than any other pump made for the same purpose. In every detail the Booster is precision-built... for failure-proof performance... long life.

Leak-proof seal. Precision-ground ...positively prevents water leakage into bearings.

Shaft and bearings. Shaft is hardened, polished steel. Bronze bearings are diamond bored... *extra long* for quiet, long-lived operation.

Lubrication system. Genuine oil circulating system positively protects the bearings.

Thrust collar. Specially hardened against wear... prevents noisy end-play.

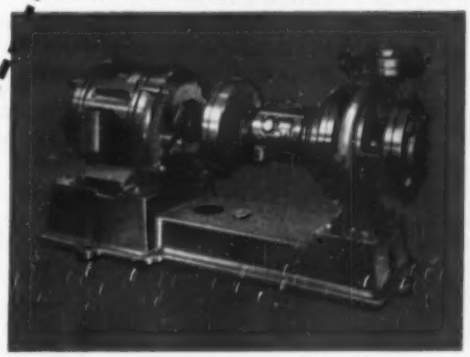
Spring-type Coupler. Simple, dependable... contributes to quiet operation. Shielded for safety.

Impeller. A true centrifugal design... balanced for smooth operation.

Motor. Specially designed and built to operate quietly. ¾", 1" and 1¼" Boosters have 1/12 H.P. motors but have exactly the same pumping capacity as previous models with larger motors.

COMPARE THE B & G UNIVERSAL PUMP

Not an ordinary centrifugal pump, but designed specifically to provide the quiet operation essential to forced hot water heating system operation. Has all the basic features of the B & G Booster.



For complete information send for B & G Catalog

BELL & GOSSETT COMPANY

Dept. DF - 5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto

FOR SUMMER COMFORT,

the U. S. National Bureau of Standards rates multiple layers of aluminum FIRST

among all insulations it tested, as reported in its booklet,

"Effect of Ceiling Insulation upon Summer Comfort," BMS52.

(You can get it at our expense.)

To be comfortable in summer you must ward off unwanted heat rays or radiation. Most heat flow thru a *roof space* in summer is by radiation. There is no convection down, and little conduction thru low density air.

Temperatures can reach over 140° F. in some attics. With an absorptivity for heat rays of only 3%, reflectivity 97%, and emissivity 3%, multiple accordion aluminum is an effective shield against summer heat. The slight mass of its components, air being preponderant, makes it very low in heat storage.

COST OF AIR-CONDITIONING REDUCED

This shield against radiant heat lifts part of the load from house-cooling equipment, reducing installation and up-keep costs. But the building, which is *not* artificially cooled, needs this shield even more!

Multiple accordion aluminum is also markedly effective against radiation through a *wall space.*

Air of higher outside temperatures will support more vapor than the cooler air inside a building. Often vapor flows from the outside to the inside of the house, obedient to the law of physics that vapor travels from areas of greater to less density.

Multiple accordion aluminum has long, continuous metallic sheets on *both* sides which are impervious to water vapor. Infiltration under the flat, stapled flanges is slight. The scientific construction of multiple layers of aluminum, fiber and air spaces, minimizes condensation formation on or within this type of insulation. Timber rot, crumbling plaster, peeling paint, etc. are minimized.

COST OF INFRA INSTALLED
in new construction between wood joists, material with labor

Type 6-S$_i$ under 9½¢ sq. ft.
Type 4-S$_i$ under 7½¢ sq. ft.

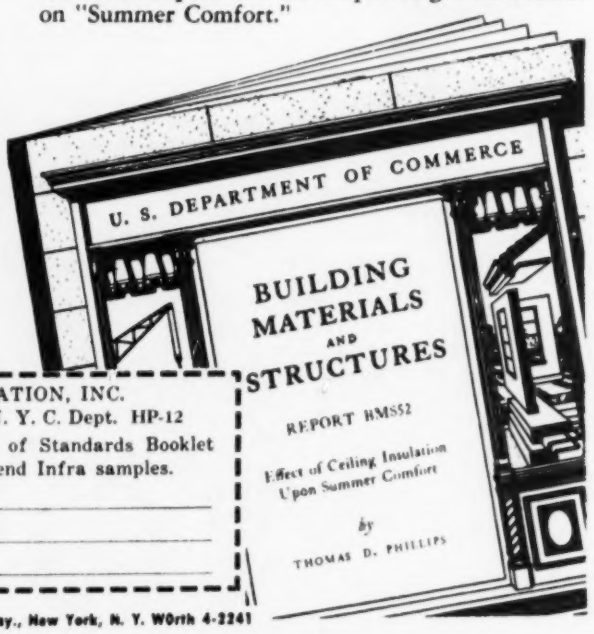
CAUTION: *We do not recommend that vapor barriers be placed on both sides of all insulations.*

IN WINTER, NEED FOR INFRA EVEN GREATER

The low conductivity, the slight heat ray absorptivity and emissivity of multiple accordion aluminum, and the retarding of inner and outer convection by the multiple layers of metal and fiber, amazingly effective in summer, assume paramount importance in winter when this 3-fold bar to outward heat flow cuts fuel bills and increases comfort.

NEW INSULATION NOW GIVES EDGE TO EDGE COVERAGE

Multiple accordion aluminum is now available which completely covers and protects the space between studs or joists with a "blanket" of uniform depth. Commercially, it is available as Infra Insulation, Types 6-*Si* and 4-*Si*. Write for description and samples. Use the coupon to get the booklet on "Summer Comfort."



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525 Broadway, N. Y. C. Dept. HP-12

☐ Send Bureau of Standards Booklet BMS52. ☐ Send Infra samples.

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INFRA INSULATION, INC., 525 Bway., New York, N. Y. WOrth 4-2241

THE EDITORS' PAGES

• 1953 *has been a big year for air conditioning. And from where we stand now — and from the expressed opinions of both those within and outside "the industry" — next year, and the years to follow, will be even bigger. Heating, too, continues to progress — as it has for many years — in importance and techniques, and piping finds ever-wider applications (snow melting, for example) . . . . . So we wish you, now, a Merry Christmas, and a busy and prosperous New Year!*

"Tremendous Demand Requires Air Conditioning Expansion"

REGARDLESS OF any general business setback, the air conditioning industry appears headed for expansion over the next few years at least, Wesley J. Peoples, president of United States Air Conditioning Corp., told a recent meeting of financial analysts at the Bankers Club, in New York. He declared that "the tremendous demand for air conditioning of all kinds will require years of the industry's peak production, and indeed, considerable expansion of its facilities." Public demand for modern air conditioning facilities in older structures alone will provide a tremendous market.

Mr. Peoples announced that his company is planning to more than double its capacity by taking on additional facilities.

He stressed that expansion in air conditioning "while possibly most spectacular to the general public in the window unit," is really most promising for the industry in the broader line of "true air conditioning." This embraces, he said, rapidly expanding use of air conditioning in industrial buildings, mercantile establishments, hotels and multi-tenant residences, and office buildings, as well as in the home.

"Tremendous Increase" Seen for Air Conditioning

A "TREMENDOUS INCREASE" in the air conditioning of offices, stores, factories and homes will be achieved in the next few years, according to a survey of the 232 exhibiting companies made by the management of the Refrigeration and Air Conditioning Exposition, which was held in Cleveland last month.

Setting one-third the total number of units as the tentative market maximum, because of income and varying climate conditions, the study showed that exhibiting companies believe one-third of all offices in the country will be air conditioned within four and one-half years, and that a similar number of retail stores will be air conditioned within five years. One-third of all homes should be air conditioned within eight years, according to the study, and one-third of all factories within 12 years. Automotive air conditioning is also expected to be a major factor.

The exposition was the biggest yet held, the 62,500 sq ft of space representing an increase of 15 percent over the record high of the Chicago show two years ago. This year's exposition was the first under the sponsorship of the Air Conditioning and Refrigeration Institute, which was formed earlier this year by a merger of the Refrigeration Equipment Manufacturers Association and the Air Conditioning and Refrigerating Machinery Association.

The institute — basing its estimate on 1953 sales trends — predicts that refrigeration and air conditioning equipment will reach an all-time sales peak in 1954.

Foresee "Second Biggest Business Year"

"STRONG REASSURANCE" as to the business outlook for 1954 is the prevailing tone of reports by 138 leading economists recently polled by Thomas S. Holden, vice chairman of F. W. Dodge Corp.

Next year will likely be "the nation's second biggest business year," according to majority opinion. Mr. Holden says that the economists think "the anticipated drop from the boom levels of 1953 will be quite mild."

Moderately declining construction activity is expected by a majority, as measured in 1954 by estimates to be made by the government. They forecast that next year's government totals will be down 8 percent from 1953 in dollar volume. The majority expect this decline will be partly due to moderate price declines and to lessening of overtime, although higher hourly wage scales are expected.

There is general expectation of a decline in residential building, but nevertheless of a big year of more than 1,000,000 non-farm dwelling units, which would be a decline of about 7 percent from what is expected to be this year's total in dollars.

"Spread Cooling Sales the Year 'Round"

ONE OF THE GREATEST challenges to the rapidly growing air conditioning industry is that of spreading its sales on an orderly year 'round basis, according to G. K. Iwashita, general manager of the commercial products department of General Electric's air conditioning division.

This is particularly true of commercial packaged equipment which goes into stores, restaurants, offices and factories, he said. This past summer, there were too many businesses that had to ride out the summer without air conditioning because installing contractors just couldn't get to them in time, according to Mr. Iwashita.

HPAC Index for '53 Being Compiled

AN INDEX FOR HPAC's 1953 issues, Vol. 25, Nos. 1-12, including the Journal Section of the American Society of Heating and Ventilating Engineers, is being compiled and will be available after the first of the year to HPAC's subscribers on request. If you want a free copy, send a note or postcard to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

We'll keep your request on file until the index has been printed, and will then mail a copy to you.

"Quote"

"Most gas utility companies have a well saturated winter load but would like to have outlets for summer fuel. Gas as a fuel for air conditioning and refrigeration is one such outlet.

"Air conditioning and refrigeration represent a tremendous summer load. Power companies in some sections of the country have found it necessary to add capacity as fast as they can get equipment delivery, mainly just to keep up with demand for cooling power. It would be natural to assume that the market for comfort cooling equipment would be found primarily in the southern regions of the country. A graphical map of the United States which appeared in the May 1953 issue of Heating, Piping & Air Conditioning indicates the relative importance of the different states as an air conditioning market. This map shows that with the exception of the Rocky Mountain states, Vermont, New Hampshire and Maine, an astonishing potential exists all over the country rather than just in the South.

"There is a tremendous air conditioning market. This market represents a large summer load for the utility that can get it and right now the gas industry isn't getting much of it. The gas industry does have equipment available for procuring a part of this load. There is a need, however, for new types of gas fired prime movers and improvement of existing design. For those gas utilities desiring additional summer load, air conditioning presents a most logical market.

"Someone is going to supply the motive power for this surging air conditioning market. The requirements for this fuel or power are in the summer, the best possible time for a gas utility." — *from a talk by W. A. Collins, Jr., Air Conditioning Sales Coordinator, Lone Star Gas Co., Dallas, at the annual convention of the American Gas Association.*

Directory Section Has New Feature

THE COMPLETE Directory Section of Heating, Piping and Air Conditioning Equipment for Industrial, Commercial, Institutional and Public Buildings — thoroughly revised and brought up-to-date — to appear for the 20th consecutive year is being readied for publication in next month's HPAC.

In addition to the complete product classifications, trade names and manufacturers' addresses, a new feature is an additional product classification of all equipment on which information is given in the advertising pages of the same issue.

Boilers Automatically Fired Show Gain

NINETY-FOUR point two percent of boilers sold during the first six months of 1953 were automatically fired as compared with 89.7 percent in 1952, the Institute of Boiler and Radiator Manufacturers reports.

In 1948 only 50 percent of the boilers sold were designed for automatic firing with oil, gas or stokers, according to the institute.

The average weight of boilers sold during the first six months of 1953 was 1091 lb, as compared with 1488 lb in 1948 and 1620 lb in 1945, says the IBR.

Steel Boiler Sales Up, SBI Meeting Is Told

SALES OF steel boilers the first eight months of 1953 were up 21 percent above sales during the corresponding period in 1952, R. A. Locke, president and manager of the Steel Boiler Institute, reported at the SBI's fall meeting.

Production and shipments of steel boilers are almost the same this year as they were in 1950 which, Mr. Locke pointed out, was the industry's biggest year. He predicted that 1953 will probably exceed 1950 in total heating surface.

Break Ground in Dallas for Air Conditioned Hotel

GROUND WAS BROKEN in Dallas recently for one of the largest hotels to be built anywhere in the world in more than a quarter of a century — the 1001 room, completely air conditioned Dallas Statler.

The $15 million, 18 story hotel will be the first multi-storied building to make full use of "flat slab cantilever" construction. Employment of the cantilever principle will eliminate about half the columns and footings necessary in older type buildings, according to the architect, William B. Tabler, of New York City.

Oil Burner Shipments Increase

SHIPMENTS OF large commercial and industrial oil burners for the first eight months of 1953 increased 22.5 percent over the same period in the previous year, according to R. H. L. Becker, managing director of the Oil-Heat Institute of America.

Another Big Chicago Building Air Conditions

AIR CONDITIONING of the basement, first and second floors of the Peoples Gas building, on Chicago's Michigan Ave., was announced last month. It is the first step in a multi-million dollar modernization program which it is expected eventually will include air conditioning of all rentable space in the 21 story structure. However, air conditioning above the sixth floor has not as yet been authorized by the company's board of directors.

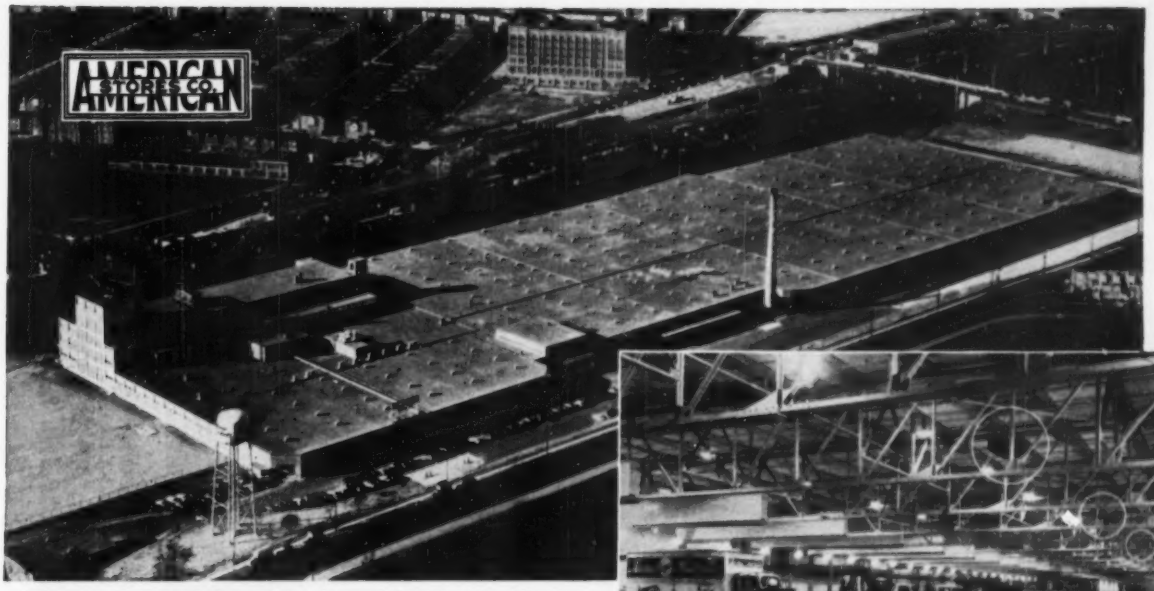
The new project is an important addition to the city's air conditioned downtown buildings, which include the existing Standard Oil building, also on Michigan Ave., and the new Prudential building just off Michigan a few blocks to the north.

Naess & Murphy are the architects and engineers for the Peoples Gas project, as well as for the Prudential job.

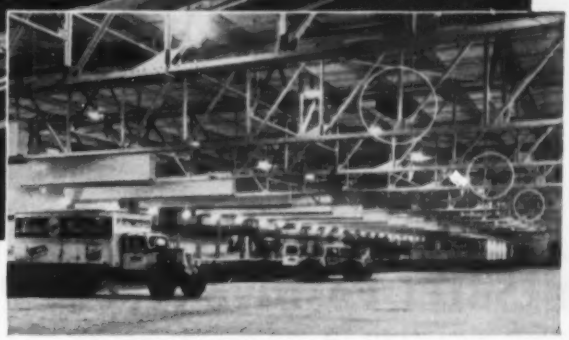
Charles U. Williams, Oil Heating Pioneer, Dies

CHARLES U. WILLIAMS, founder of the Williams Oil-O-Matic Heating Corp., and a pioneer in oil heating, died at the age of 86 at his home in Bloomington, Ill.

He was the organizer and first president of Williams Oil-O-Matic, which became the Eureka Williams Corp. in 1945. An automobile dealer during World War I, he found himself faced with the problem of keeping his garage open on "coal-less" Mondays. To meet the situation, his son Walter built an oil burner. Within six years the oil burner business had outgrown available space in the garage, plus the top four floors of an adjacent theater building.



Aerial view of all-new bakery and warehouse of American Stores Company, Philadelphia. Bakery occupies 3-story building at left. Warehouse has platform and siding space for 85 trucks, 22 freight cars. Engineers and Architects: Ganteaume & McMullen, Boston. General Contractor: Hughes-Foulkrod Company, Philadelphia. Heating Contractor: W. M. Anderson Company, Philadelphia.



Webster-Nesbitt Little Giant Down-Blow Units (circled) spot heat throughout high-ceilinged truck-loading area.

Heating a Bakery-and-Warehouse Giant

Steam at 125 lbs. pressure serves dual purpose in mammoth new bakery and warehouse: Supplies needs of bakery equipment and heats vast area through 200 Webster-Nesbitt Unit Heaters . . . Use of high pressure steam allows savings in initial cost of system.

In designing the heating system for this American Stores Company bakery and warehouse in Philadelphia, Ganteaume & McMullen, Boston specialists in bakery construction, chose steam at 125 lbs. pressure. Webster-Nesbitt Unit Heaters are supplied with steam at both 125 lbs. and 35 lbs. High pressure steam permitted worthwhile savings in size of unit heaters and piping.

Low temperature coils in Webster-Nesbitt Unit Heaters reduce temperature of discharged air so that it reaches the floor from heights of 20 to 25 feet. Heat is spotted *where* it is wanted, delivered in the required volume *when* it is wanted. Heated air is mixed thoroughly with room air . . . reduces temperature-stratification and overheating in upper areas . . . assures quick heating, low fuel cost, greater comfort.

Heating equipment includes 141 Little Giant Unit Heaters, 40 Propeller-Fan Units, 17 Giant Blower-Fan Units, 2 Series R Unit Heaters; also Webster Low Pressure Thermostatic Traps, Drip Traps and Dirt Strainers.

Webster's experienced field organization serves architects, engineers and heating contractors. If you plan new construction or heating modernization, call the nearest Webster Representative, or write us for his name.

Address Dept. HP-12

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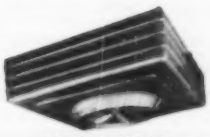
Webster HEATING

Webster-Nesbitt Giant Blower-Fan Unit

Webster-Nesbitt Series R Unit

Webster-Nesbitt Propeller-Fan Unit

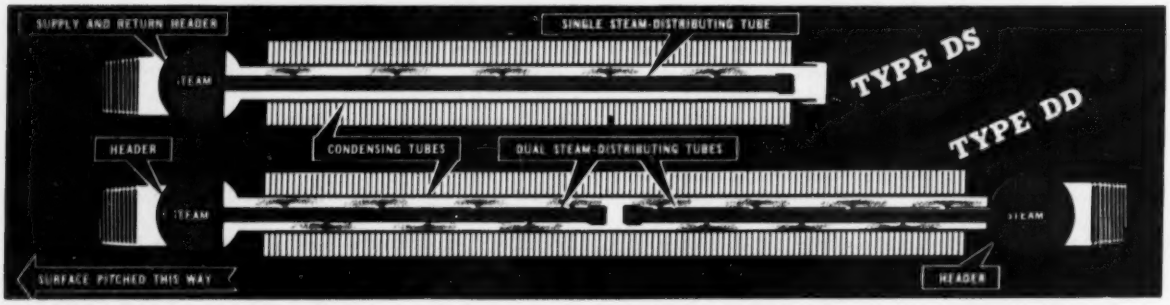


Webster-Nesbitt Little Giant Unit

* NESBITT Positive Freeze Protection

results from (1) Uniform Steam Distribution, and (2) Condensate always exposed to entering Steam

NESBITT SERIES D SURFACE IS MADE IN TWO TYPES:



TYPE DS SURFACE: Single supply header; single steam-distributing tube inside each condensing tube, for normal heating and ventilating applications. For installations requiring more uniform discharge temperatures, Type DS Surface with DUAL steam-distributing tubes in finned lengths up to six feet.

TYPE DD SURFACE: Two supply headers (one at each end of the surface section); DUAL steam-distributing tubes inside each condensing tube; steam conducted from the header at each end toward center. Assures uniform discharge temperatures over finned lengths from 78" to ten feet.

How STIFF are the surface requirements in that low-pressure, valve-controlled job of yours? Must you have *strictly uniform discharge temperatures*, regardless of coil length? Then specify Nesbitt Series D Heating Surface with DUAL steam-distribution tubes. Or do you have *less exacting requirements*, but still need acceptable distribution, regardless of coil length? Then specify Nesbitt Series D Heating Surface with SINGLE steam-distributing tubes. All Nesbitt Series D heating coils are *freeze-proof* without the aid of pre-heaters because of the steam-distributing tube feature, developed by Nesbitt. Play safe: say *Nesbitt.*

FREE: Publication 247, Nesbitt Series D Heating Surface; Publication 248, Nesbitt Series H Surface, for Heating, Ventilating, Drying; Publication 246, Nesbitt Series W (Water) Surface, for Air Cooling, Dehumidifying, Heating.

OFFICES IN ALL PRINCIPAL CITIES—LIST UPON REQUEST

"OPEN FOR DISCUSSION"

WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

[The Air Filter Institute's new code for testing air filters was described by A. Nutting and R. F. Logsdon in the June HPAC. Because of the interest in and importance of the subject of testing and rating air cleaning devices, considerable attention has been given since then to comment — both pro and con — on the code. Messrs. Nutting and Logsdon make their reply this month to the comments that have appeared in HPAC since June.]

A. NUTTING, R. F. LOGSDON —

"We Urge All To Adopt This Code"

WE BELIEVE THERE is no point to be gained in further discussion of the accuracy, reliability or soundness of the AFI test code. Mr. Farr has stated his opinions about the efficiency of the absolute filter; others have questioned other elements of the procedure. On the other hand, we have established that the mechanics of the test are sound and have submitted data as proof thereof. If further doubt exists, we invite the doubter to satisfy himself by actual test.

Mr. Farr states that the three essential factors (resistance, efficiency and dust holding capacity) for judging air filter performance were satisfied by the old ASHVE code. It was because of the unwieldiness and misinterpretation of the old ASHVE code that that society appointed a technical advisory committee to revise the code, and Mr. Farr was a member of this committee and is acquainted with the circumstances. The ASHVE technical advisory committee worked for several years to check sampling procedures, authorized extensive duct changes, isokinetic sampling studies, velocity distribution studies at sampling points, dust distribution studies at sampling points, etc. — all of this on the premise that the old ASHVE code did not satisfy the above-mentioned three essentials. Because this work gave little promise of satisfactory conclusion in the reasonably near future, the Air Filter Institute devised the AFI code on the basis of the best information available.

Objectors to the AFI code appear to have three things in common:

a) They each manufacture only one type of air cleaner.

b) They each advocate one method for testing all types of air cleaners, though each advocates a different method.

c) They each totally ignore the question of filter life or dust holding capacity in their proposals.

All those manufacturers whose lines cover both viscous impingement and electrostatic filters are in unanimous agreement with the AFI code, we believe. Obviously they have had the most experience with both types of filters. All who manufacture both types are in agreement that viscous impingement units cannot be fairly tested by the discoloration method with atmospheric dust, and that electrostatic filters cannot be fairly tested by the weight method with synthetic dust. The reasons for this are obvious and have been stated repeatedly:

a) Atmospheric dust is so variable and discoloration efficiency so low that it is impossible to separate a good viscous impingement unit from an inferior one.

b) Efficiencies of electrostatic filters by weight method on synthetic dust are so uniformly high that it is impossible to separate a good electrostatic filter from an inferior one.

These facts are recognized by everyone who has conducted both types of tests on both types of filters. We repeat that mechanical type filters are intended to remove dust and lint — the type of particulate that lodges on heat exchange surfaces, settles out on furnishings — but are not intended to remove smoke or fumes. The latter type of particulate does not settle by gravity but is deposited by various means on walls and furnishings to cause discoloration. Electrostatic precipitation or its equivalent is required to remove discoloring particulate effectively. Such cleaners should be tested by discoloration means.

Mr. Van Orman claims a desire for "more rigid tests" and charges that the AFI code would only "add to the confusion." However, we are reminded that in his recently published work on air filter testing (ASHVE Journal Section, HPAC, January 1952, pp. 157-163) he employed several different test methods to demonstrate filter performance. Accepted and conventional means of testing were shunned by Mr. Van Orman; no data whatever was submitted that would permit comparison of performance with other filters already on the market.

This well illustrates the need of a uniform testing procedure that can be followed by the entire industry. We say the industry should test mechanical filters by a common method. Section I of the AFI code gives the user a chance to compare performance and let any product stand or fall on its own merits. The public and industry will both benefit in the long run. Similarly, with electrostatic filters or other types for which discoloration particulate removal is claimed, let them be tested by a common means — discoloration with atmospheric dust — and give the user the information he needs to compare performance.

We urge that all manufacturers of viscous impingement and dry type filters adopt Section I of the AFI code. We further urge that both the ASHVE and the AFI, as well as industry members individually, continue work on particle size analysis, uniform particle generation and particle size efficiency procedures. Certainly no one is satisfied with any currently proposed particle size efficiency method. Aside from the problem of obtaining clean fractions, the problem of dispersion of submicronic fractions remains. The industry is also in need of a reliable, practical particle determination method that can be used as a standard. Unless and until these problems are solved, the industry cannot intelligently adopt a routine test procedure based on particle size.

We appreciate the space we have been given to express our views on the AFI code and to answer the various criticisms. We hope and trust that the exchange of opinions has served to clear the air and that the AFI will now proceed with the additional sections of the code.—A. NUTTING, Vice President and Chief En-

gineer, and R. F. LOGSDON, Assistant Director of Research, American Air Filter Co., Inc.

S. L. ROOT —

"Does Little To Provide Useful Data"

WHILE THE NEW AFI code for testing air filters has fulfilled the objectives set forth in the second paragraph of the article by Messrs. Nutting and Logsdon in the June HPAC, this code will do little to provide useful rating data for the application of air filters to the everyday ventilating or air conditioning system.

Design engineers want to know how a filter will solve their problems of removing contamination from the atmosphere. To date, dust dispersed in a laboratory test has not approximated atmospheric contamination and it is doubtful that it ever will. Therefore, any tests run with a synthetic dust will give results almost completely meaningless to the design engineer and the filter user.

The rating of air filters will be clear only when manufacturers run their tests on atmospheric dust and present data showing particle size distribution and concentration upstream and downstream of the filter. Any test method designed to give this information should be sufficiently sensitive to cover the full range of particle sizes so that all types of filters in use can be rated by the same method and directly compared with one another.

Since the early 1940's, considerable work has been done by industry and various branches of the government to develop and also test better air cleaning devices. It appears that sufficiently sensitive test equipment is available and that a relatively simple research program could assemble and improve on available equipment in such a way that the air filter industry could rate its products in a manner intelligible and helpful to its customers.—S. L. ROOT, Chief Application Engineer, Filter Div., Cambridge Corp.

ALEXANDER SCHWARTZ —

"Need to Standardize Insulation Testing"

WE WELCOME AND value the article in the September HPAC on the use of reflective interior finishes in heating Arctic buildings, and agree with the authors in their expression concerning further investigation.

The 20 to 30 percent heat saving which they reported is in accord with previous experimentation over the years, indicating excellent thermal insulating properties of surfaces with high infra-red reflectivity coefficients.

In furtherance of the stated objective of this valuable paper, may I suggest the desirability of some major effort in the entire field of thermal testing toward standardization of testing methods. While the authors point to the lack of universally accepted test methods as being a recognized short-coming in this particular endeavor, the problem exists in the entire area of obtaining practical comparative thermal factors for commercial insulation materials.

It would seem within the purview of the ASHVE to act as both the initiating and guiding agency in such an undertaking for standardization, since the wide respect it commands might encourage individual investigators to accept some greater uniformity of testing methods under its aegis at the expense of small differences of opinion but for the greater good of progress in providing practical information of high calibre and consistent quality.

Perhaps we might in this way arrive at a greater understanding and agreement among experimenters in the field over points which are causing aggravation out of proportion to their possibility of resolution. — ALEXANDER SCHWARTZ, President, Infra Insulation, Inc.

DR. C. A. MILLS —

"Need Cooling With Reflective Wall Surfaces"

THE AUTHORS OF the article on the use of reflective interior finishes in connection with the heating of Arctic buildings, which article was published in the September HPAC, are to be complimented on a good piece of work and the clear presentation of definitely significant results. There can be no question that reflective facings on the room side of structure walls do definitely reduce heat loss outward from the room *when heat is put into the room in radiant form* (italicized portions of this sentence are mine). It is indeed gratifying that the authors' results detailed in the paper show substantial agreement with those published by me and my colleagues (in the references listed below) with regard to the 30 percent reduction in heat loss when a room is lined with facing materials of high reflectivity.

But it also should be borne clearly in mind that their use will interfere with a person's heat loss in non-Arctic summer heat unless mechanical cooling is available. Use of such reflective inner wall facings in association with radiational summer air conditioning results in marked cooling load reductions as compared to those of conventional air conditioning — this becomes an important factor in non-Arctic climates where indoor cooling problems exist. — C. A. MILLS, M.D., Professor of Experimental Medicine, University of Cincinnati.

[References: House Beautiful, October 1950; Popular Mechanics, October 1950; Architectural Forum, November 1950; Heating, Piping & Air Conditioning, December 1950, February 1952; Refrigerating Engineering, November 1950; The Industrial Heating Engineer (London), April 1951, August 1952]

WILLIAM J. GLEASON, JR. —

"Simplify Hook-Up With Straight-Through Trap"

WE ENJOYED reading the article "Short Circuits" in Piping, by Bill Dopp, which appeared in the September HPAC. It was very well done and we feel that it brought out some extremely important points on proper trapping.

The only comment we would like to make is on the manner in which the traps are connected. With a straight-through trap, the piping could be considerably simplified in that two fittings could be eliminated, with a corresponding saving in labor. —WILLIAM J. GLEASON, JR., The V. D. Anderson Co.

GERALD C. DITTMAN —

"I Agree With Article 100 Percent"

THE ARTICLE on hospitals in the November HPAC, by Charles F. Neergaard, is most interesting. I agree with the article 100 percent, but our main trouble in following the suggestions given in the article has been to get a client that has enough money to go to this type of fully-insulated construction. It has been our experience that they would rather spend the money on a few extra rooms whereby they can actually see cash coming in.—GERALD C. DITTMAN, Schmidt, Garden & Erickson, Architects and Engineers.

"We prefer

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TO ALL OTHER MATERIALS

for Radiant Panel Heating because of its easy workability, permanence and the assurance of a quality job"

says A. C. HARDEN
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Harden Heating & Air Conditioning Co., Elmwood Park, Ill.

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"Those are the reasons we prefer copper to all other material". And Mr. Harden speaks from experience. For he has installed copper radiant panel heating systems in over 50 churches and more than 500 residences, and all are completely satisfactory in every respect. The oldest has been in operation for 7 years.

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Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

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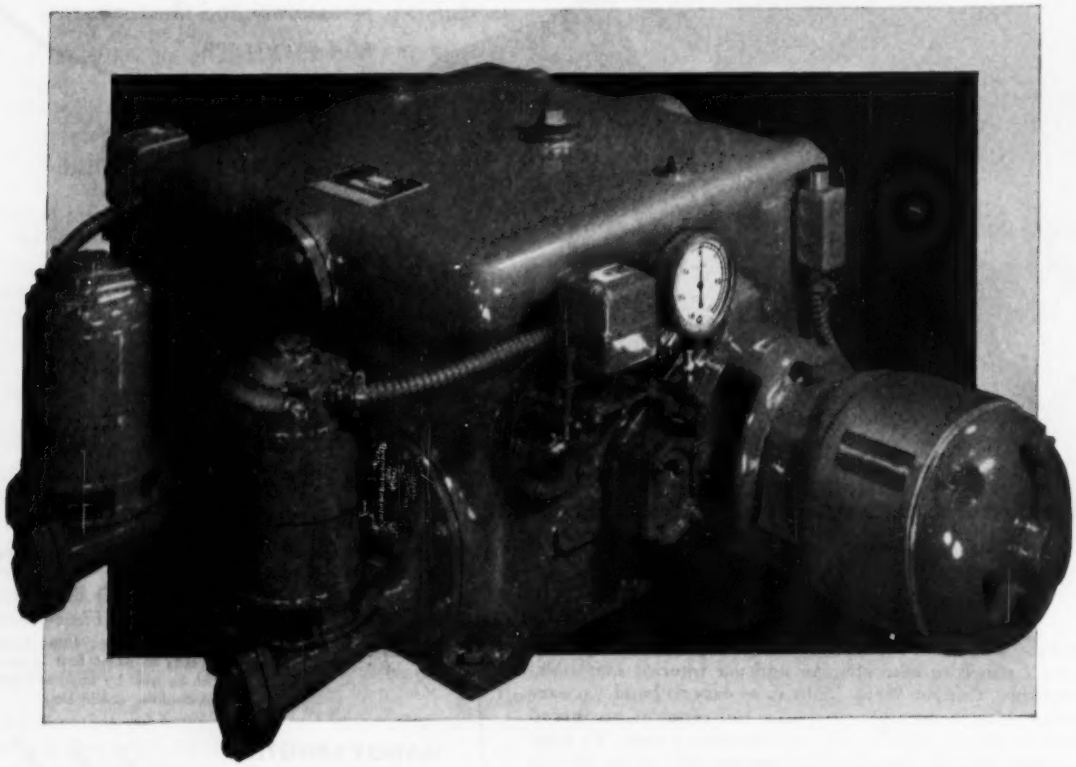

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- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
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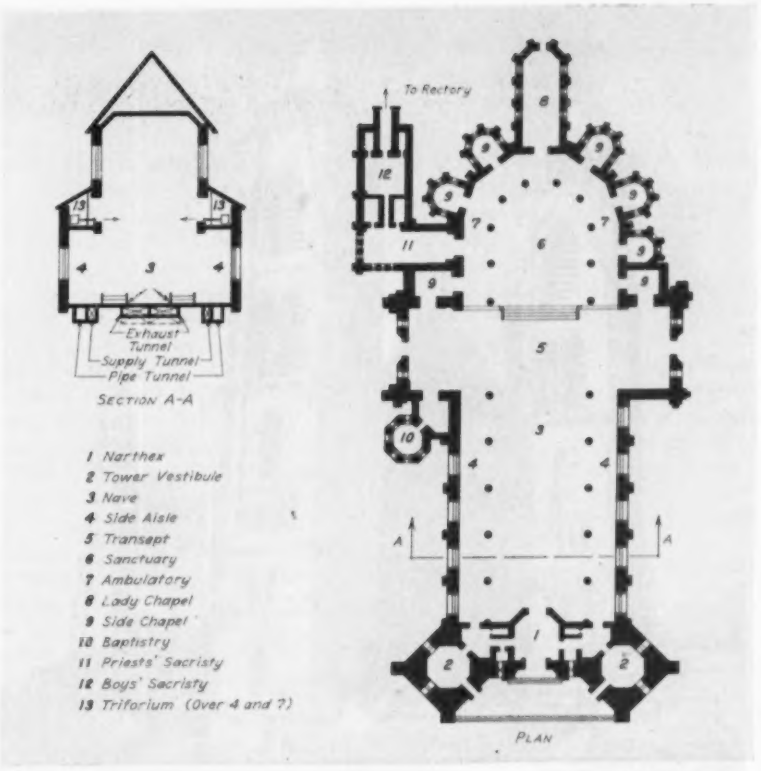


Floor Panels, Units, Central Systems

Heat, Ventilate Cathedral

By Abraham Walton
Sears & Kopf, A. Walton, Associate Consulting Engineers

CONSTRUCTION OF the Cathedral of the Sacred Heart, Newark, N.J., began in 1896 and stopped when foundation walls were built. The superstructure was started in 1911 and the building enclosed by 1919, when the work was again stopped. The sanctuary was completed and some stonework installed on the walls of the side aisles in 1928 — at which time electrical conduits and a small portion of ductwork for a combined heating and ventilating system were installed, and work was again stopped. A program was formulated in 1951 for the completion of the edifice and plans were started for interior design and the mechanical installations. In all these years, the building was not used.

Many Design Problems

Examination of the building revealed many problems to be encountered in the design of the heating and ventilating systems. A previous design, prepared many years ago, contemplated the use of one central fan system for heating and ventilating the entire structure. A fan room was constructed under the priests' sacristy, and there were two parallel tunnels under the nave around its periphery. The tunnels had plastered walls and concrete floors and ceilings, and were intended for supply and return air plenums. The areas under the side chapels and ambulatory were fully excavated.

No space was provided for a boiler plant and no chimney had been constructed, nor was provision made for them within the building. The floor slab of the nave was directly on earth fill, except for the areas over the tunnels. The choir loft, 29 ft above the nave floor, has a rose window 35 ft in diameter which comprises the greater part of the exposed wall of this area. The triforiums on each side of the nave and around the sanctuary were 41 ft above the nave floor. The ceiling over the nave and transept was 100 ft high. Large windows in the clerestory were 65 ft above the nave floor.

Small ducts concealed behind the finished stonework on the side aisles up to 13 ft above the nave floor, and the ducts concealed behind the finished walls of the ambulatory, could not be modified — and no new ductwork could be installed, as the stonework was not to be disturbed.

The entire structure is of wall bearing construction and is gothic in design.

In preparing the design for the heating and ventilating systems, the unusual experience of having such a building in this unfinished condition, and being able to work in the building while preparing ideas and studies, were of tremendous advantage. During the course of preparing final drawings the details were worked out at the site, with obstacles evident.

Floor Panels Provide Heat

Due to the fact that 20,000 sq ft of floor area is directly on earth, and because of the impossibility of installing direct radiation in suitable locations, it was decided to use radiant panels in the marble floor as the primary source of heat to provide comfortable room temperatures. It is not necessary to discuss here the merits of radiant heating, but it is certain that if the great masses of stone and marble are maintained at proper temperatures, the occupants will be comfortable. The use of floor coils throughout the sanctuary and predella, where the priests are prostrate at times, will omit the shock of cold floors and should be beneficial to their health.

The computed heat loss for the nave and transepts is 2,548,000 Btu. Floor coils of 1 in. Type B copper

BEGUN IN 1896

Begun in 1896 in Newark, construction of the Cathedral of the Sacred Heart stopped when the foundation walls were built, resumed in 1911 and again stopped in 1919, and in 1928 the sanctuary was completed and some stonework was installed.

When a program for completion of the edifice was formulated in 1951, examination of the building revealed many problems to be encountered in the design of the heating and ventilating systems. The unusual experience of having such a building in unfinished condition, and being able to work in the building while preparing ideas and studies, were of tremendous advantage.

The installations are now nearing completion. Mr. Walton describes how the heating and ventilation problems were worked out.

tubing are spaced 18 in. on centers throughout the nave and transept. Such coils 12 in. on centers in the side aisles and at entrances to the transepts provide a total output of 976,160 Btu. The coils are divided into six zones for these areas to provide smaller pump sizes, smaller main sizes and greater flexibility of control. These coils total 12,590 ft. Three additional zones, comprising 6555 ft of 1 in. tubing, provide for the heating of the sanctuary, ambulatory, side chapels, lady chapel, narthex and tower vestibules; all are arranged according to the usage of the spaces. In all, a total of 19,145 ft of tubing comprise the entire radiant floor panel system.

Units Supplement Panels

Since sufficient output from the panels could not be obtained to satisfy the total heat losses under design conditions, supplemental heating is necessary. The large glass area in the clerestory, while greatly increasing the heat losses, also presents the problem of possible downdrafts due to convected air currents. It was decided to install unit heaters of the centrifugal fan air handling type on the triforium floor level at either side of the nave and over the sanctuary, to recirculate and stratify the air at that level, prevent the downdrafts, and at the same time to introduce sufficient heat in severe weather to satisfy the heat losses not made up by the floor coils. The side chapels, narthex and tower vestibules have recirculating unit heaters installed in excavated areas below, and connected with ductwork, for supplemental heating.

The radiant floor panels of the narthex and tower vestibules will also serve to keep the floors dry when people are entering in rainy or snowy weather, and avoid the tracking of wet feet onto the nave floor.

The lady chapel heating is of similar design except that outdoor air is introduced through a unit heater in the excavated area below, to provide for ventilation when required. Recirculating cabinet heaters installed under the large window of the choir loft will keep this area heated. The baptistry is heated entirely by a recirculating unit heater. Sacristies and other spaces are heated with copper convector type radiation. The design provides for 60 F in the nave, narthex and vestibules, and 70 F in all other spaces, with an outside temperature of zero.

The Ventilation Scheme

Ventilation of the nave is provided by a central fan system to introduce outdoor air and exhaust fans for removal of foul air. Due to space limitations, only one supply fan system could be installed. Existing tunnels are utilized as supply air plenums. Outdoor air, tempered in winter, can also be introduced during non-heating seasons.

A similar type of system will provide ventilation for the sanctuary, utilizing a central fan system and ductwork connecting to the existing flues and outlets in the ambulatory. The nave and transept have a total volume of 1,500,000 cu ft; the sanctuary and ambulatory have a combined volume of 420,000 cu ft. The supply air fan for the nave and transept will deliver 78,000 cfm, while the fan for the sanctuary and ambulatory will deliver 20,000 cfm. Air will be exhausted from the side aisles, center aisle under the pews and ambulatory. Five exhaust fans with a combined capacity of 100,000

cfm, at various points throughout the cellar and tunnel levels, will be connected to exhaust openings by means of ductwork and tunnels. One exhaust fan of 30,000 cfm capacity in the attic above the transept will remove the air from the ceiling during hot weather. Exhaust air from the center aisle will pass through the crypt under the sanctuary. By utilizing the crypt as a plenum, the crypt will be ventilated, and dampness and foul odors will be eliminated without the necessity of additional separate supply and exhaust systems. Each exhaust fan will be arranged for two speed operation to provide maximum flexibility.

Temperature Control

The heating and ventilating systems will be under full automatic temperature control of the pneumatic type. Each zone of the radiant heating system is controlled by a room thermostat operating a three-way valve for full modulation of water temperatures. The circulators will run continuously. Two convertors will heat the water for the radiant system and a 170 gpm centrifugal pump will continuously circulate the water through a live main run in the tunnels around the periphery of the building. A standby pump is also provided and cross-connected to the piping system.

Each zone of the radiant system is connected to the live main. Water temperature in the distribution main is controlled by an aquastat operating an automatic valve on the steam connection to each convertor. All steam, return and water distribution piping is black steel. The piping in the tunnels is welded. Joints between steel pipe and copper tubing do not have special insulation, as no electrolytic action is anticipated.

Each unit heater, air handling unit and central fan system is controlled by its respective automatic steam valve.

All the ventilating fans, unit heaters and air handling units can be operated from a central panelboard.

Boiler Plant, Rectory Combined

Since no space was available within the building to construct a boiler plant, it was decided to excavate an area adjacent to the building. The need for a rectory to service the cathedral became a requirement of the diocese. It therefore became a logical solution to combine these two functions into one building. However, a new problem was created — that of heating the new three story rectory. Additional space was required in the boiler room to provide for the heating and domestic hot water requirements of the rectory, so that the originally designed areas had to be enlarged.

Upon our recommendations, it was agreed that the heating plants for both buildings should be independent of each other. This recommendation was made from past experiences in many such buildings. The heating requirements are different in each building, and the operation of large boilers to supply the comparably light demands of the smaller building — especially in mild weather when the larger building does not require heat — is not economically advisable. In actual operation, the indoor temperatures in the smaller building would fluctuate too much, it was felt, due to the long "off" periods of the burners.

The heating system for the rectory is two pipe forced hot water, with all major rooms individually controlled by a pneumatic temperature control system. The sacristies — while a function of the cathedral — will require heat at times when the cathedral will not require heat; therefore, these rooms have been connected to the rectory system and zoned separately.

Three cast iron sectional boilers will produce the steam required for the cathedral and a smaller one will be used for heating and domestic hot water requirements of the rectory.

Gas Selected

Numerous conferences and analyses of installation and operating costs resulted in our recommendations to utilize gas for fuel. The local utility company installed a 5 in. gas service at 5 psi pressure, a governor to regulate the pressure to the burners, seven meters and meter piping, and will maintain and service the burning equipment, all at no cost to the owners. These items were large contributing factors in selecting the type of fuel. A fully automatic power type burner delivering 10,000,000 Btu per hr, with gas at a pressure of 18 in. WC and of 557 Btu content, is installed in each of the larger boilers. The burner for the smaller boiler will deliver 2,700,000 Btu.

The installations are nearing completion, and should prove of great interest to all. Problems encountered during construction can be discussed, temperature readings will be possible at varying heights up to the 100 ft ceiling level with only the radiant floor panels in operation, and fuel consumption and fuel costs will be available after at least one full year of operation.

In establishing the design of these systems, it was determined to provide modern methods of heating and ventilating with the greatest flexibility, so that fully automatic operation with the least possible maintenance could meet the variable needs of such a beautiful edifice.

The heating and ventilating contractor is Frank A. McBride Co.

[Photo courtesy L. J. Wing Mfg. Co.]

Environmental Equipment Manufacturers Organize

ORGANIZATION OF a new manufacturers' association — the Institute of Environmental Equipment Manufacturers — has been announced by Dr. George D. Wilkinson, general manager. Headquarters are at 30 Church St., New York City.

Environmental equipment simulates low temperatures, high temperatures, salt spray, sandstorms, rain, altitude, etc. It is used for laboratory testing of equipment to be used by the military and to determine the effects of weather on plastics, automotive parts, washing machines, etc. Environmental equipment also is used in manufacturing processes — for example, to cool rubber so that it can be machined and to shrink metal parts for shrink fitting.

One of the institute's functions will be to supply technical data on environmental testing. A library will be maintained, standards will be prepared, and technical bulletins will be disseminated.

Passes a Milestone

ACCORDING TO a published interview with W. Paul Jones, president of Servel, Inc., in the magazine Printers' Ink, his company passed a "significant milestone" last May, when the air conditioning division "billed more dollars than the refrigerator division."

THE METHOD of calculating flexibility discussed in this article was used in this recent installation

Calculating Flexibility

. . . for Straight Line Piping Elements

By L. E. Partch

Smith, Hinchman & Grylls, Inc.
Architects & Engineers

MODERN PIPING DESIGNS make use of welding fittings and straight lengths of pipe with a considerable increase in flexibility. In this "straight line element" system, circular arcs are considered as a series of straight lengths. Generally, a right angle bend having a radius of five diameters may be represented by two straight segments without sacrifice of precision.

The procedure for determining the force required to bend a straight length of pipe may be obtained from the C. T. Mitchell method. This method has been widely accepted for single plane elements. The treatment of the third dimension pipe structure, however, is difficult to use on account of the lack of true relation between the elements and the line action of force.

General Concept of Elements

In the third dimension, the straight line element is subjected to primary bending due to the action of the force. In addition, most third dimension elements are subjected to torsion and a secondary bending action. These three actions produce three independent deflections for each element. The sum of the deflections of all of the elements of a pipe system for an arbitrarily selected force, as compared to the actual deflection or free expansion of the system, enables the designer to determine the actual force that is set up by a change in temperature in the system.

It is the purpose here to set up a procedure for determining the force required to bend and twist an element of the third dimension. With this as a tool, the designer may then calculate the force set up by the temperature change in a system composed of many elements. When the force has been determined, the stress at any point may then be calculated.

Single Plane Elements

Where flexibility problems are confined to a single plane, the formula for deflection of a straight line element located at any angle with respect to a line of force is the first consideration. In these single plane problems, the deflecting force acts along a line which lies in the same plane as that of the deflected elements.

The general expression for the deflection of a pipe element as presented by Crocker and Sanford is:

$$\Delta_B = \int_A^B \frac{M^B}{FEI}\, dL \qquad (1)$$

Referring to Fig. 1, and Equation [1], the symbols are:

Δ_B = Deflection or movement of the point of application of the force F in the direction in which the force acts. Δ_B is expressed in inches and may be calculated from the coefficient of expansion multiplied by the projected length of the pipe element along the line of the force F;

L = Length of the straight section of pipe extending from A to B, in.;

M = Bending moment at any point along the length A, B, in.-lb;

F = Force, lb;

E = Young's modulus of elasticity, psi;

I = Moment of inertia of the cross section of the pipe, in.^{4}

In Fig. 1 the end A is at a distance y_1 from the line of action of the force

and B is at a distance y_2. At any point along the line, the bending moment M is Fy. Squaring both sides,

$$M^2 = F^2y^2 \quad \text{.....[2]}$$

From Fig. 1

$$dL/dy = L/(y_1 - y_2), \text{ or}$$

$$dL = dy \times L/(y_1 - y_2) \quad \text{....[3]}$$

Substituting equations [2] and [3] in equation [1],

$$\Delta_B = \int_A^B \frac{F^2y^2L}{FEI(y_1 - y_2)}\,dy$$

$$\Delta_B = \frac{F}{EI}\,\frac{L}{(y_1 - y_2)}\int_A^B y^2\,dy$$

$$\Delta_B = \frac{F}{EI}\,\frac{L}{(y_1 - y_2)}\,\frac{(y_1^3 - y_2^3)}{3} \quad \text{.....(4)}$$

This is simplified as

$$\Delta_B = \frac{F}{EI}\,\frac{L}{3}(y_1^2 + y_2^2 + y_1y_2) \quad \text{.....(5)}$$

The expression $L/3\ (y_1^2 + y_2^2 + y_1y_2)$ is referred to in the author's article in the July 1950 HPAC as the flexibility index k.

Special Cases of k values

When L is parallel to F, $y_1 = y_2$. Then

$$k = Ly^2 \quad \text{.....[6]}$$

When one end of L touches the line F, $y_2 = 0$

$$k = Ly^2/3 \quad \text{.....[7]}$$

When the length L crosses the line of force F, it is necessary to consider that the line L is in two sections and equation [7] is used for each section.

When L is at 90 deg to F and F is applied to one end, $y = L$. Then

$$k = L^3/3 \quad \text{.....[8]}$$

Equation [8] is found in structural handbooks as the cantilever equation.

The k value,

$$L/3(y_1^2 + y_2^2 + y_1y_2),$$

is the same as the area of the moment diagram multiplied by the distance from the centroid of the area to the line of action of the force F as given in the article entitled "A Graphic Method for Determining Expansion Stresses in Pipe Lines," by C. T. Mitchell, Trans. ASME F.S.P. 52-25-1950.

Use of k values

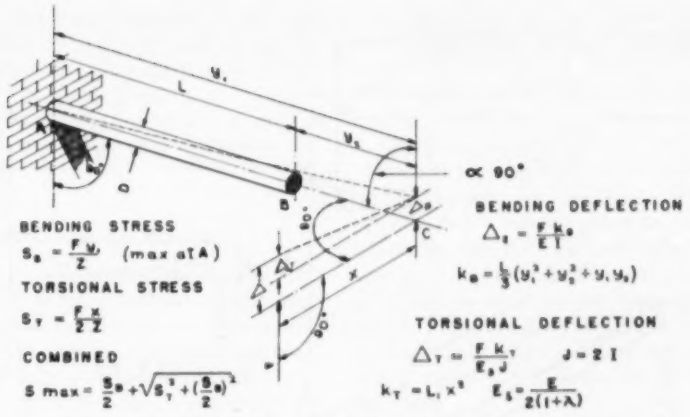
In the Mitchell article, a portion of which has been reprinted in Kent's Handbook, the ends of the expansion bends are assumed to be 100 percent fixed, the moment of inertia of the pipe is constant throughout the length and it is assumed that the force developed by the expansion between the fixed anchors acts along a neutral axis which passes through the center of gravity of the line representing the shape and, in such cases, is parallel to the line which passes through the anchor points.

It is generally accepted that this latter concept is true in symmetrical figures. Under certain conditions, however, the line of action may not be parallel to the line joining the anchors, as in the case where one end may be rigidly anchored and the other end may be a hinge.

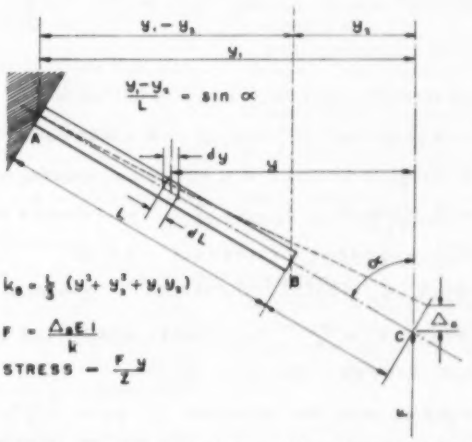
Regardless of the various conditions that may arise, if such a line of action of the force can be located, then the y distances of the various straight line sections can be measured from the line of action of force and the k values of each of the straight line elements can be calculated and added together to obtain the flexibility value K of the whole structure.

If the elements of a flexible pipe structure were free to expand away from one anchor point, the opposite anchor point would move through the distance Δ_R — called the deflection. The force F is then required to move it back to its original position. Generally, the line of action of F does not pass through the anchor points but is off to one side, resulting in a bending moment at the anchor points.

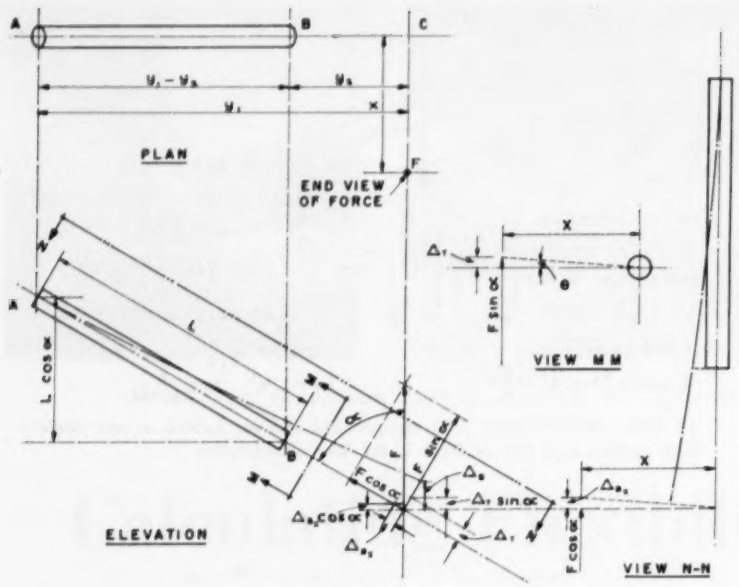
In all cases of structures subjected to expansion there are two forces which are equal and opposed. In the case of an increase in temperature,



1 THE DEFLECTION of a straight line element located at any angle with respect to a line of force is the first consideration



2 A SIMPLE CANTILEVER is shown with a force located at the distance X from the plane of the element



TOTAL DEFLECTION $\Delta = \Delta_B + \Delta_{B_2} \cos\alpha + \Delta_T \sin\alpha$ $\sin\alpha = \frac{y_1 - y_2}{L}$

$\Delta_B = \frac{F k_B}{E I}$ $k_B = \frac{L}{3}(y_1^2 + y_2^2 + y_1 y_2)$ E = MODULUS OF ELASTICITY

$\Delta_{B_2} \cos\alpha = \frac{F \cos^2\alpha \, k_T}{E I}$ $k_T = L x^2$ L = LENGTH OF PIPE

$\Delta_T \sin\alpha = \frac{F \sin^2\alpha \, k_T}{E_s J}$ $E_s = \frac{E}{2(1+\lambda)}$ λ = POISSON'S RATIO

$I = \frac{\pi(d_1^4 - d_2^4)}{64}$ = MOMENT OF INERTIA $J = 2I$

BENDING STRESS $S_b = \frac{\sqrt{(F_Y)^2 + (F \cos\alpha \times)^2}}{Z}$ Z = SEC. MOD.

PRESSURE STRESS $S_p = \frac{P A_f}{A}$ A_f = FLOW AREA A = METAL AREA

TOTAL TENSILE STRESS $S = S_b + S_p$

SHEARING STRESS DUE TO TORSION $S_T = \frac{F \sin\alpha \, x}{2Z}$

COMBINED MAX. STRESS $S_{max.} = \frac{S}{2} + \sqrt{(S_T)^2 + (\frac{S}{2})^2}$

3 THE ELEMENT is arranged in the most general position with the force *F* resolved into two components

they are acting toward each other subjecting the flexible structure to compression. In refrigeration, flexible pipe structures are generally in tension.

In single plane figures the forces developed by the expansion may be calculated directly:

$$F = \Delta EI/K \quad \ldots\ldots\ldots\ldots\ldots\ldots [9]$$

in which K is the sum of the k values of the various straight line elements composing the structure.

The stress at any point is

$$S = M/Z \quad \ldots\ldots\ldots\ldots\ldots\ldots [10]$$

In equation [10], $M = Fy$, and Z is the section modulus of the pipe cross section. The stress at any point along the pipe line is proportional to the y distance of such a point from the line of action of the force F. It is essential that the line of action be located correctly in order to obtain the correct values of the force and also the correct values of stress at various points.

Third Dimension Elements

A pipe element of the third dimension is treated by passing a plane through the element so that the plane will be parallel to the line of action of the deflecting force and is at a distance X from that line. This couple of $F \times X$ is resisted by torsion and secondary bending and the resultant, equal to F, acting in the plane containing the element, produces the primary bending action that has been treated under the section of Single Plane Elements.

In Fig. 2 a simple cantilever is shown with a force located at the distance X from the plane of the element. It is clear that there is a torsional deflection in addition to the primary bending deflection. Under the conditions shown in Fig. 2 there is no secondary bending deflection.

In Fig. 3 the element is arranged in the most general position. The force E is resolved into two components, one of which is at right angles to the element and is $F \sin \alpha$, which produces the torsional deflection Δ_T in the direction of $F \sin \alpha$. The component of the torsional deflection in the direction of F is $\Delta_T \sin \alpha$.

Torsional Deflection

The equation for torsion is similar in form and in units to that of the primary bending equation. Referring to Fig. 3, it appears that $F \sin \alpha$ which is at right angles to the line of the pipe element, produces an angular deflection in the lever arm X, which is shown as the angle Θ. The general formula for torsion is:

$$\Theta = TL/E_s J \quad \ldots\ldots\ldots\ldots\ldots [11]$$

where T = Torsional moment, $T = XF \sin \alpha$, and E_s = Modulus of elasticity in shear.

$$\Theta = \Delta_T/X \quad \ldots\ldots\ldots\ldots\ldots [12]$$

where θ = Angle of twist, expressed in radians.

Then

$$\Delta_T/X = TL/E_s J \text{ or}$$
$$= F \sin \alpha \, LX/E_s J \text{ or}$$
$$\Delta_T = F \sin \alpha \, LX^2/E_s J \quad \ldots\ldots [13]$$

The flexibility index Kt used in the Hovgaard problem of the first article is the expression

$$LX^2 \quad \ldots\ldots\ldots\ldots\ldots [14]$$

The deflection in the direction of F is $\Delta_T \sin \alpha$. Multiplying both sides of the equation [13] by $\sin \alpha$,

$$\Delta_T \sin \alpha = F \sin^2 \alpha \, K_T/E_s J \quad [15]$$

L = Length of element of pipe;

X = Distance from the plane containing the element of pipe to the line of action of the force F which is parallel to the plane;

α = Angle between the line of the pipe element and the projection of F on the plane containing the pipe element; The sine of α is $(y_1 - y_2)/L$ and $\sin^2 \alpha + \cos^2 \alpha = 1$;

$E_s = E/2(1 + \lambda)$ where λ is Poissons Ratio given in Crocker's Piping Handbook, p. 829;

J = Polar moment of inertia = 2 I.

Secondary Bending Deflection

The component of F that is parallel to the line of the element is $F \cos \alpha$, which produces the deflection Δ_{B2} in the direction of $F \cos \alpha$.

The bending moment of this force, $F \cos \alpha$, is constant along the length

L. Since $F \cos \propto$ is parallel to L, the flexibility index is

$L/3(X_1^2 + X_2^2 + X_1X_2)$ or since $X_1 = X_2$

this becomes

$LX^2 = K_T$ (see equations [6] and [14]

Then,

$$\Delta_{B2} = F \cos \propto K_T/EI \quad \ldots\ldots [16]$$

The deflection in the direction of F is $\Delta_{B2} \cos \propto$. Multiplying both sides of equation [16] by $\cos \propto$,

$$\Delta_{B2} \cos \propto = F \cos^2 \propto K_T/EI \quad \ldots [17]$$

It will be noted that when $\propto$ is 90 deg, as in Fig. 2, $\cos \propto = 0$, and there is no secondary bending action, hence no secondary deflection.

When $\propto$ is 0 deg, there is no torsion. The distances y_1 and y_2 are both 0 so that the primary deflection becomes 0. The deflection is entirely from the secondary bending action.

Determining the Force

A pipe structure composed of straight line elements will be subject to a total deflection Δ as calculated from thermal expansion of the structure as a whole. This actual deflection produces the force F.

Due to the fact that the denominator E_sJ is different from EI in equations [5], [15] and [16], it is necessary to calculate the three deflections that are produced by each element of the pipe structure with an assumed force of say 1000 lb. These minute deflections are then added in a tabulation as in the Hovgaard problem. (See page 95 in the July 1950 HPAC.) The actual force set up by the thermal expansion is then determined by the proportion,

Actual Force = 1000 lb $\times$ Δ calculated from thermal expansion divided by the Δ calculated for 1000 lb .....[18]

Determining the Stress

After an evaluation of the force is made it is then possible to determine the stress at any point in the structure. The bending and torsional moments must first be determined.

The secondary bending moment is

$M_2 = F \cos \propto X$.

This is at right angles to the primary bending moment which is

$M_1 = Fy$.

The resultant bending moment is

$$M = (M_1^2 + M_2^2)^{1/2} \quad \ldots\ldots [19]$$

The bending stress is

$$S_B = M/Z \quad \ldots\ldots [20]$$

in which M must be calculated from equation [19], and Z = Section modulus of pipe.

The internal pressure stress is

$$S_P = PA_F/A \quad \ldots\ldots [21]$$

where P = Fluid pressure, psi; A_F = Area of flow, sq in.; A = Area of metal, sq in.

The total tensile stress is

$$S = S_B + S_P \quad \ldots\ldots [22]$$

The torsional stress is

$$S_T = F \sin \propto X/2\,Z \quad \ldots\ldots [23]$$

The total stress due to tension and the torsional stress are then to be combined to give the maximum fiber stress,

$$S_{max} = [S_T^2 + (S/2)^2]^{1/2} + S/2 \quad \ldots [24]$$

A structural designer would not think of selecting a beam unless he knows where the loads are imposed. It is equally essential that the piping designer locate the line of force that is set up by the thermal expansion.

He will then be able to determine the magnitude of the force, the bending and torsional moments and stress. He will then know if the design is sufficiently flexible. If cold springing is necessary to keep the stresses within allowable limits, he will be able to locate such cold spring joints where the stresses are at a minimum.

[In the July 1950 HPAC, the author presented the solution of two flexibility problems in "A Straight Line Method." The derivation of the formulas used in this earlier article was omitted for the reason that the scope of the subject of these formulas is more general than that of the problems cited.

Sabin Crocker and Sterling S. Sanford presented "The Elasticity of Pipe Bends" at the annual meeting of the ASME in December 1922. Section 17 of that paper gives the derivation of the formulas for the deflection produced and stress developed in a section of pipe when a force is applied. These formulas serve as the foundation of the work extended in this present article.

In the Crocker-Sanford paper, circular segments and tangents (straight lengths) were given primary consideration. The calculus was used, involving trigonometric integrals for the solution of circular arcs that were common in the designs of that time.]

[The author wishes to thank B. F. Giffels and O. H. Pocock of Giffels & Vallet, Inc. for their kind assistance in preparing this article.]

New Highway Has Snow Melting in Ramps

BOSTON'S NEW $50 million aerial highway, now under construction and known as the Boston Central Artery, will include the largest snow melting installation in the country. Heating pipes will keep snow and ice from the access ramps.

The heating of ramp pavement not only will protect motorists from skidding but also will eliminate a major cause of traffic congestion in winter. Although each of the 14 individual ramps in the downtown area has its own grid system, the total area served amounts to more than 139,000 sq ft of pavement. More than 200 tons of wrought iron pipe will be used in the snow melting systems; also more than 50 tons of steel pipe in the steam piping to the pump houses is used.

To operate the systems, steam supplied by the Boston Edison Company will be fed to heat exchangers. Water mixed with ethylene-glycol antifreeze will be circulated through the heat exchangers and piping grids.

Shop fabricated wrought iron grids, typically 10 ft by 25 ft, were selected for the ramps. One inch pipes run across the roadway and are welded into 2 in. headers. Holes are drilled through the wall of the 2 in. header of the same size as the interior dimension of the 1 in. legs; then, a recess is formed around the edge of the drilled hole of the same diameter as the outside of the 1 in. pipe. The 1 in. leg, when inserted in the recess and welded in place by means of a bead entirely around the joint, is thus held securely in place. The grids are piped in series rather than in the usual parallel arrangement.

Another feature of the ramp systems is the method employed to relieve air-binding in the grids. Since the grid headers run up the slope of the ramps, they are made to butt each other. A ½ in. thick baffle plate is welded between the dead corners of the butting headers. A ⅜ in. hole is drilled through the top of the header — thus, it is expected that any air which may collect at the dead corners will work its way through the holes to the top of the continuous grid combinations, where provision is made for its elimination.

The design was made for the Massachusetts Department of Public Works by Charles A. Maguire & Associates and Fay, Spofford & Thorndike, consulting engineers of Boston.

TEMPERATURES AT 144 LOCATIONS can be monitored at the electronic precision indicator and switch panel, before which the author is seated

Temperatures at His Finger-Tips

Centralized monitoring of readings throughout air conditioned building saves money, promotes efficiency and comfort

By C. L. Gier

Superintendent of Mechanical Engineering
The Companion Companies

How do you monitor and control temperature and humidity in a building containing over 5½ million cu ft? What happens to heating or cooling system loads when over 2300 people enter the building at 8 a.m.?

These questions had to be answered in planning the heating and air conditioning systems for Mutual of Omaha and its companion companies, United Benefit Life and United Benefit Fire Insurance. The original building, completed in 1940, consists of five floors and a basement; the addition, completed in 1948, has nine floors and a basement. Our experience with the installation is believed to be of general interest.

In order to insure optimum working conditions in the building, regardless of variations in outside temperature and humidity, inside temperature is maintained at 76 F throughout the year, while relative humidity is kept at 35 percent in the winter and 50 percent in the summer.

For heating, a forced hot water system with convector radiators recessed under the windows is utilized. Hot water is supplied by heat interchangers. Steam requirements are met by three low pressure, oil burning boilers. Usually only one of these boilers is operating; the second is cut in when the outside temperature drops to 26 F, and the third at 10 F. Each boiler is rated at 178 hp.

Taking Temperatures Quickly

As a means of knowing when and where thermostat set-point adjustments are necessary, we must know quickly and accurately the temperature in any given part of the building.

It is estimated that it would take approximately 5 hr for a man to take temperature readings throughout the building. The cost of this time is perhaps relatively unimportant. The significant fact is that during such a length of time conditions would change, and corrective action could easily lag several hours behind these changes.

A temperature monitoring system in our ground floor office provides an effective answer to this problem. This system, utilizing an electronic precision indicator and a series of multiple key switches, provides for the measurement — by wall mounted thermocouples — of temperatures at 144 different points.

At present, 119 temperatures are monitored — in every private office, in every zone of each floor, outside the building, in chilled water lines, in the air intake, and in numerous other locations. The remaining switches will be used for the monitoring of additional temperatures as the necessity arises.

CHANGES IN CONTROL SETTINGS are made by the operating engineer at the master control panel

MONITORING TEMPERATURE conditions in 5½ million cu ft of building is a big job. It is estimated that the equipment described paid for itself in two years

To provide for inside temperature control, thermostats are installed at appropriate locations — in most cases, mounted near the monitoring thermocouples. Temperature setting knobs on these thermostats are inside the locked cases, so that settings may be changed only by members of the maintenance staff.

Advantages of Method

One measure of the complexity of the system is that we have — to date — installed over 44,000 ft of thermocouple wire from the many measuring elements to the precision indicator. This is a lot of wire, but its installation has paid handsome dividends. A complete temperature survey of the building can be made in a matter of minutes, and this speed has proved of great value.

To give but one specific example —during a severe winter snowstorm the dampers on the outdoor air intake froze open. Ordinarily, it is highly possible that such a condition would not be detected for several hours. During this time, the thermostats would attempt to maintain their set temperature, and an excessive amount of steam would be consumed.

Actually, however, the rapid, routine check made possible by the monitoring system enabled us to detect and remedy the abnormal condition in a short time. The saving in steam costs in such cases is evident, but the preservation of comfort in the building is an equally important factor — especially where, as here, approximately 80 percent of the employees are women, who, as a general rule, are more temperature conscious than men.

The conditioned air is introduced into all the clerical areas and some offices through perforated metal ceilings. Except in the basement and other unfinished areas, all pipes and ducts are concealed.

Considering the savings in utilities and labor, we originally calculated that the entire temperature monitoring system would pay for itself in three years. That figure has since been lowered to two years — excluding the comfort and convenience factors.

1025 Tons of Refrigeration

The summer air conditioning system utilizes one compressor plant for both the original building and the addition. This plant, with a total capacity of 1025 tons, consists of one 725 ton centrifugal compressor and six 50 ton reciprocating compressors. Pneumatic type automatic control is utilized on both the heating and air conditioning systems.

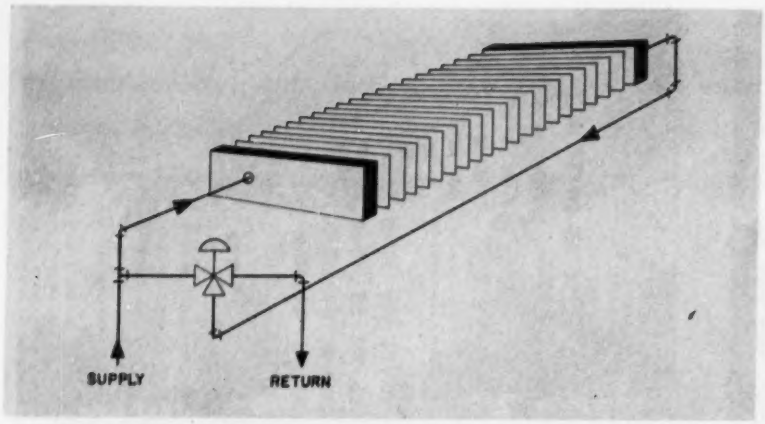
Air handling equipment is separate for the original building and the addition, but in each case electrostatic air cleaners, air washers and automatic controls are utilized. Outdoor air is introduced through a set of automatically controlled maximum-minimum dampers. The air travels down through 10 floors of ductwork into the equipment room, where automatic controls provide for humidifying or dehumidifying, cooling or heating, as the requirements may be.

Other Instrumentation

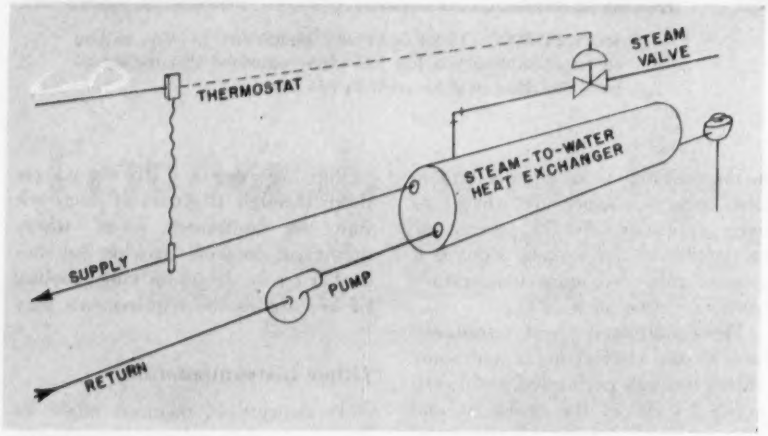
In conclusion, mention might be made of other related instrumentation. In order to insure that outside air does not enter the building except as desired, an indicating pressure controller is used to maintain the static pressure inside the building slightly higher than that outside. One pressure tap to this instrument is inside the building and one outside, so that the instrument functions as a differential pressure controller. The instrument achieves control by regulating a pneumatic motor on the exhaust fan vortex.

Also of interest is the employees' cafeteria, in a separate building, but connected to the main building by a tunnel. The entire cafeteria building is heated and air conditioned through a common duct system. Steam and chilled water for use in the cafeteria system come from the plant in the main office building. There is a separate exhaust system for the kitchen, the dining area and the toilets.

[Photos courtesy Minneapolis-Honeywell Regulator Co., Industrial Div.]



1 THREE-WAY MIXING valve permits the water to flow through the coil, or to bypass the coil as required by the unit controls



2 THE THERMOSTAT may control a throttling valve in the steam supply line with a steam-to-water heat exchanger

Controlling Unit Ventilators on Hot Water Systems

By Harold W. Alyea

Chief Field Engineer
Johnson Service Co.

The control of unit ventilators when hot water is the heating medium is discussed in this third of a group of articles by Mr. Alyea on the fundamentals of control of unit ventilators for school rooms.

The first article, in the October HPAC, covered the application of unit ventilators and the various temperature control cycles. The second article, in November, explained improved methods of control and new developments in unit ventilator construction.

Another article will discuss unit ventilators on steam systems — with particular reference to valve capacities, valve sizing and the variables affecting proper valve operation.

WHILE STEAM IS the more common heating medium used with unit ventilators, the use of hot water is not uncommon. The basic control arrangements and most of the other considerations are not altered when hot water is used instead of steam.

The manufacturers of unit ventilators can furnish hot water units as well as steam units. The outward appearance and mechanical arrangements are the same for both types — a hot water coil being substituted for the steam coil. In many cases, the substitution of a throttling hot water valve in place of the throttling steam valve is the only change required in the control system. However, because of differences in the connections to the coil, the location of the valve may be somewhat different than in the same unit that is designed for steam.

Hot Water Supply

Most hot water heating systems employ a hot water boiler which supplies the unit ventilator directly. A discussion of the controls, safety devices and other accessories for the hot water boiler is beyond the scope of this article. Some hot water heating systems, however, are used in buildings where steam is required for other purposes, and in such cases a steam-to-water heat exchanger may be used for providing hot water. This arrangement also may be used where street steam is available.

Regardless of the source of hot water, a pump is required to circulate it through the heat exchanger or boiler, the distribution pipes, the unit ventilator coils and any auxiliary radiators, convectors or other heating units. This pump usually is installed in the return line near the boiler or water heater and, of course must be selected with sufficient capacity to force the desired quantity of water through the complete circuit. Also, the pump must be large enough for the maximum water flow required when all of the automatic control valves are wide open.

Throttling or Pressure Control?

As the automatic valves in the unit ventilators throttle, the quantity of water flowing will decrease, and the pressure is increased because of the pressure-flow charac-

teristics of the centrifugal pump. Most pumps used for heating service have impellers designed for non-overloading — in other words, on a decrease in flow, the pressure builds up only so high, and then remains relatively constant or falls off slightly.

If the pump is selected for its point of maximum efficiency, the head pressure will not be too far below its maximum value, and a large increase in pressure will not occur as the flow is reduced. Therefore, throttling valves can be used in the unit ventilators without any further consideration.

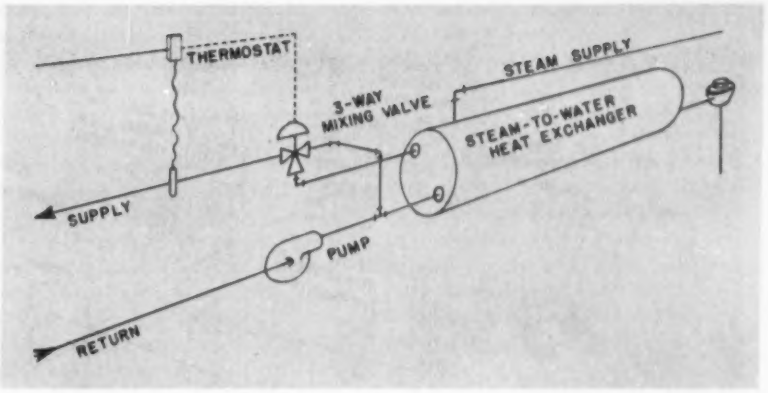
In cases where the head pressure will build up excessively at reduced flow, it may be necessary to use some form of pressure control for the water system. The simplest consists of a bypass line between the pump discharge and the pump suction, in which a spring loaded relief valve is installed. Normally, the valve in this bypass is closed and the system functions in the conventional manner. On an increase in pressure above the setting of the spring, the valve opens and bypasses some of the discharge water back into the suction side of the pump.

Another arrangement consists of a normally closed pneumatic valve in the bypass line, controlled by a pneumatic pressure regulator. This is somewhat more flexible than the spring loaded relief valve, permits more ready adjustment if necessary, and the pressure controller can be mounted on a central panel, if desired, for better accessibility. In some cases, it is desired to control the difference in pressure between the supply and return line, and in this event a differential pressure regulator may be used.

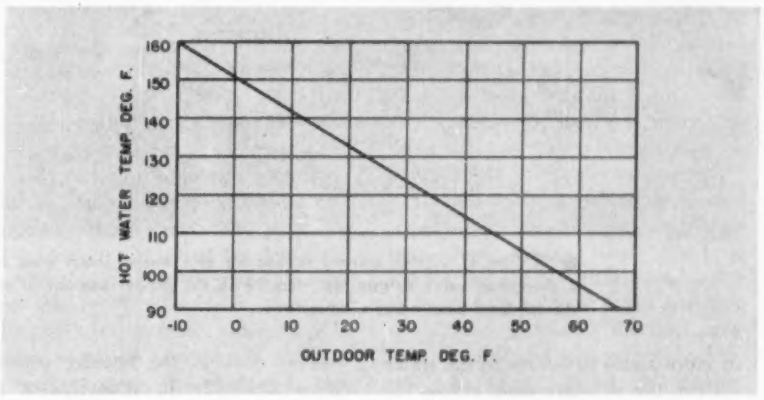
Three-Way Mixing Valves

The use of three-way mixing valves on hot water unit ventilators eliminates the problem of pressure variations in the system. The mixing valve permits the water to flow through the coil or to bypass the coil, as required by the unit controls, and therefore the same quantity of water flows through the system at all times. A typical piping arrangement for a three-way mixing valve on a unit ventilator coil is shown in Fig. 1.

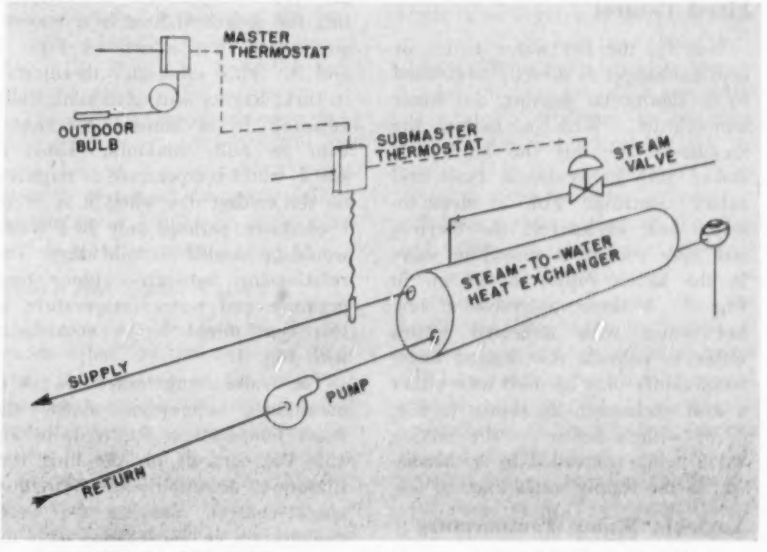
Because the mixing valve results



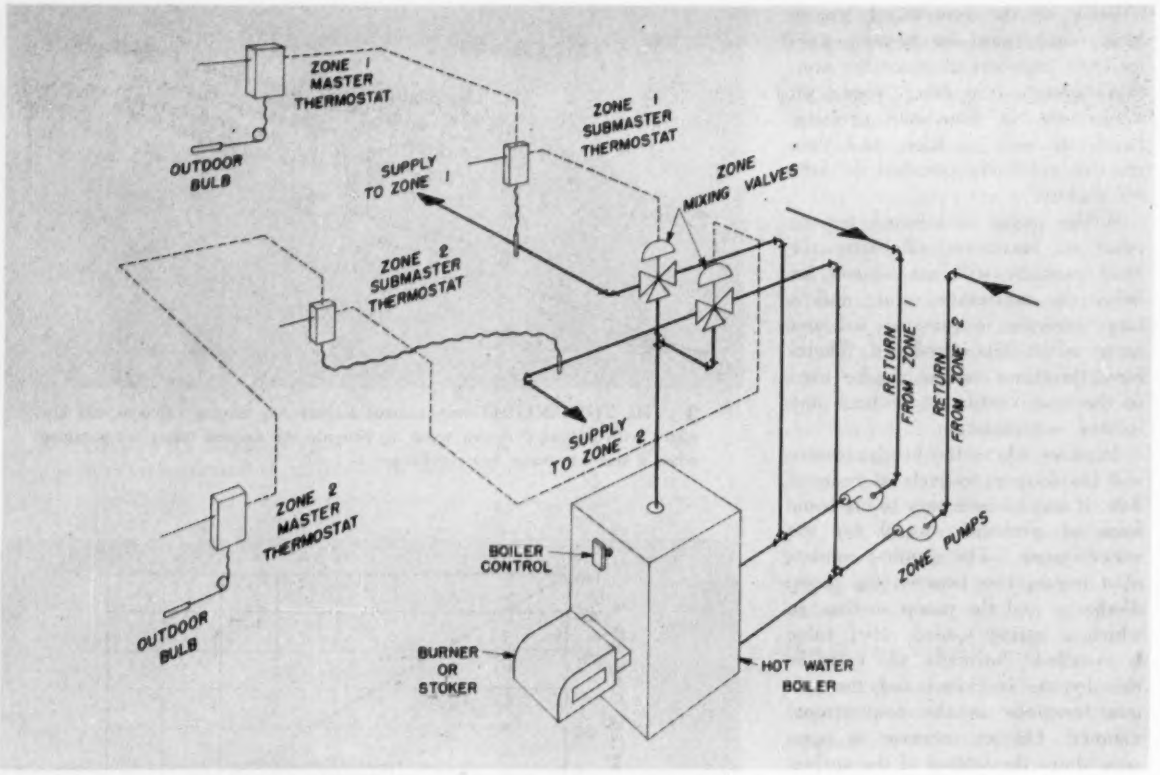
3 THE THERMOSTAT may control a three-way mixing valve to mix hot water with unheated return water to provide the desired water temperature when a steam-to-water heat exchanger is used



4 TYPICAL RELATIONSHIP between hot water and outdoor temperature on a weather compensated system



5 TYPICAL CONTROL system which varies the water temperature with the weather demands



6 TYPICAL ZONE control system for two zones. Each zone submaster thermostat controls a three-way valve to mix hot water with the proper amount of return water, which results in the required zone water temperature

in more stable pressures in the water system, the pressure drop across the valve remains relatively constant, and the unit is easier to control than when a straight throttling valve is used.

Fixed Control

Usually, the hot water boiler or heat exchanger is directly controlled by a thermostat sensing the water temperature. With a boiler, the thermostat controls the burner or stoker with conventional limit and safety controls. For a steam-to-water heat exchanger, the thermostat may control a throttling valve in the steam supply as shown in Fig. 2. A three-way valve to mix hot water with unheated return water to provide the desired water temperature may be used with either a heat exchanger, as shown in Fig. 3, or with a boiler — the mixing valve being controlled by a thermostat in the supply water line.

Variable Water Temperature

Since the maximum water temperature is required only during the coldest days in the heating season, it is desirable in many cases to vary the water temperature in accordance with the outside weather. This may be accomplished by a submaster thermostat sensing the supply water temperature and controlling the source of heat in a manner similar to that shown in Figs. 2 and 3. This submaster thermostat, in turn, has its setting automatically adjusted by a master thermostat with its bulb outdoors. Thus, if 160 F water temperature is required on the coldest day when it is — 10 F outdoors, perhaps only 90 F water would be needed on mild days. The relationship between outdoor temperature and water temperature in this case might be in accordance with Fig. 4.

The water temperature always is maintained somewhat above the exact temperature required, to enable the controls on the unit ventilators to accomplish the individual space control. Varying the water temperature in accordance with the outdoor weather relieves the unit controls of a part of their duty, with corresponding better control resulting. Fig. 5 shows a typical master-submaster control arrangement. Outdoor compensation of the hot water temperature is sometimes accomplished with a single instrument, rather than with master and submaster thermostats. Such an instrument would have two sensing elements, one outdoors and one in the hot water line, but the net result would be the same.

What About Zoning?

In some schools, variations in exposure or other conditions may make it desirable to divide the water system into two or more circuits or zones, with each zone controlled by separate master-submaster thermostats. In this case, the source of hot water is controlled at a fixed value, and each zone submaster thermostat controls a three-way valve to mix hot water with the appropriate amount of return water which results in the required zone water temperature. Fig. 6 shows such an arrangement.

Wherever more than one zone of

hot water is used, it seems imperative that individual zone pumps be employed. With a single pump serving all zones, the return lines must be connected together ahead of the pump, and thus the return water from all zones is mixed. As often happens in such cases, the supply water temperature required for a zone on the sunny side of the building may be lower than the combined return water temperature, and hence that zone cannot receive water as cool as required. To install a single pump on a multiple zone job defeats the very purpose of the zoning. Individual zone pumps keep the returns separated. Any zone can receive water as cool or as warm as required.

Protecting Against Freeze-Ups

A review of the unit ventilator cycles discussed in the October and November articles will serve as a reminder that some outdoor air is always being taken into the unit, regardless of how low the outdoor temperature is. This suggests that some consideration should be given to the matter of possible freezing of water in the coil.

If hot water is kept continuously circulating through the coil there is no danger of freezing, regardless of the temperature or quantity of outdoor air. Thus, the first requirement for freeze protection is to guard against failure of the pump. The usual method of accomplishing this is to install a pressure-actuated electrical switch in the pump discharge, arranged to stop the fans in all of the units on that particular pump circuit if the pump pressure fails. This requires properly arranged wiring circuits — but the usual practice is to install wiring circuits so that all units can be started and stopped from a central point anyway. Stopping the unit fans automatically closes the outdoor air dampers and effectively guards against freezing.

Even with the pumps running, however, the room thermostat can close the coil valve on its respective unit and prevent water from circulating through the coil. This is true whether three-way mixing or straight throttling valves are employed. The air stream thermostat provides effective protection against freezing in this event. In most unit ventilator cycles, the air stream thermostat is in the discharge air stream and, by opening the coil valve, prevents this temperature from falling below 60 F, regardless of the action of the room thermostat. Thus, whenever the temperature of the air mixture entering the coil is below 60 F, the coil valve must be partly open. When this mixture temperature is at or below freezing, the valve is open sufficiently to assure good water circulation without danger of freezing.

In other unit ventilator cycles, the air stream thermostat is in the outdoor air and return air mixture, usually is set for 60 F and freezing of the water in the coil is prevented by assuring that air at freezing temperature does not enter the coil.

Other Methods of Protection

Some engineers prefer the installation of a thermostat in each unit, with its bulb located so as to sense the temperature of water in the coil, for freeze-up protection. This thermostat usually is set for about 40 F or 50 F and is arranged either to close the outdoor air damper or to stop the unit fans, in the event the temperature of the water drops to the thermostat setting. In the latter case, the outdoor air damper automatically closes when the fans stop.

In some cases, hot water coils can be furnished with a pipe tapping for the thermostat bulb. In other cases, it is necessary to insert the bulb in a tee connection in the return line leaving the coil. In either case, a separable well for the bulb should be installed to avoid having to drain the system in case the bulb must be removed for any reason.

The use of a freeze protection thermostat in each unit eliminates the need for protection against pump failure. However, the pump failure protection is simpler in most cases and is more common.

Sizing Hot Water Valves

In selecting the size of the hot water valve for the unit ventilator coil, it is necessary to know the maximum quantity of water required and the pressure drop through the valve. With these two factors known, the valve manufacturer's tables or charts will give the correct size.

The quantity of water required can easily be obtained from a knowledge of the heat requirements of the room, at design conditions, and the water temperature drop for which the coil was selected.

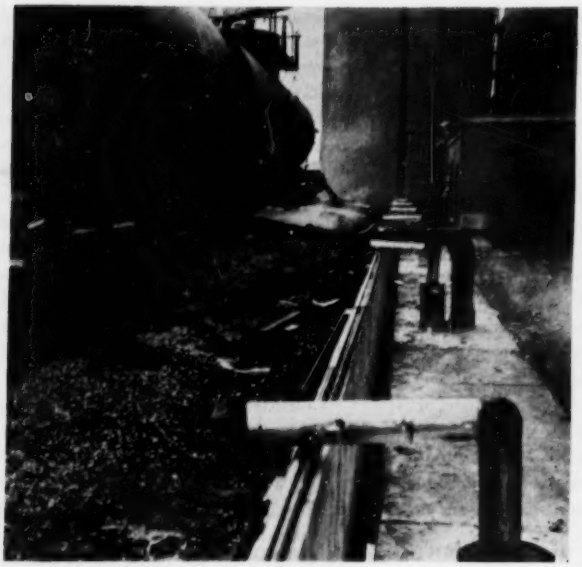
The correct pressure drop is not quite so easily determined. From the standpoint of good control results, it is desirable that the pressure drop through the valve be an appreciable amount. This point is too often overlooked, and when it becomes time to size the control valve, the pipe sizes have already been determined, the pump selected, and sizing the control valves is — at best — a compromise.

Consider a hot water system which must circulate 200 gpm to the coils of a group of unit ventilators. The piping circuit has been designed and pipe sizes selected so that the total friction head, including the pressure drop through the coils, is 30 psi. A pump which will deliver the required 200 gpm against a 30 psi head also has been selected. Such a system undoubtedly would function satisfactorily as long as there are no control valves in the circuit.

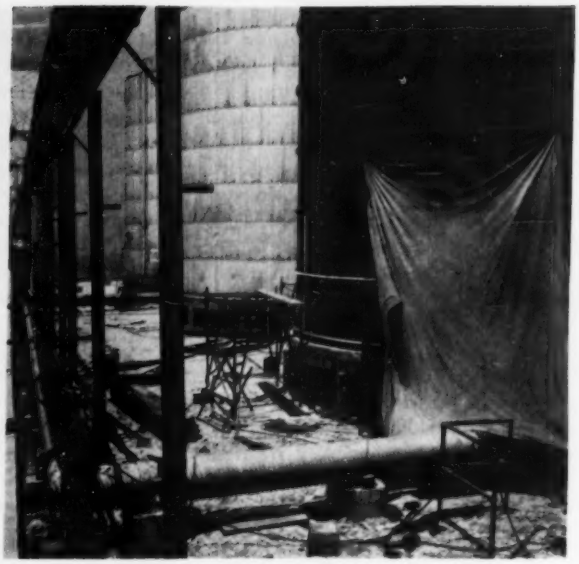
If control valves are installed in the supply lines to each unit ventilator coil, these valves being sized to handle the correct quantity of water in each case with a 6 psi pressure drop across the valve, the total pressure drop of the system becomes 36 psi. Operating against this higher head, the pump will deliver less than the required amount of water. Because of this, the tendency is to select the control valves with the least possible pressure drop, usually about 1 or 2 psi, and the result is a sacrifice of the best possible control.

It would be much better to assume a reasonable pressure drop across the valve, say 5 or 6 psi, on ordinary low pressure hot water systems, include this in the total pressure drop, then select the pump accordingly.

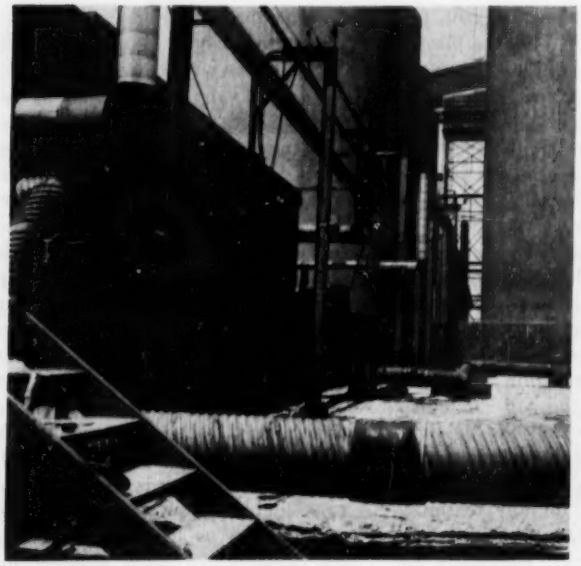
While correct sizing of the control valves on a hot water system is not nearly as important as it is on a steam system — because there are fewer variables to contend with — proper consideration of this matter will be more than repaid in improved control performance. It should be remembered that all valves are not alike and that there are different types of inner valve construction and port sizes for a given nominal valve size. Hence, the correct size cannot be determined without reference to the manufacturer's capacity tables.



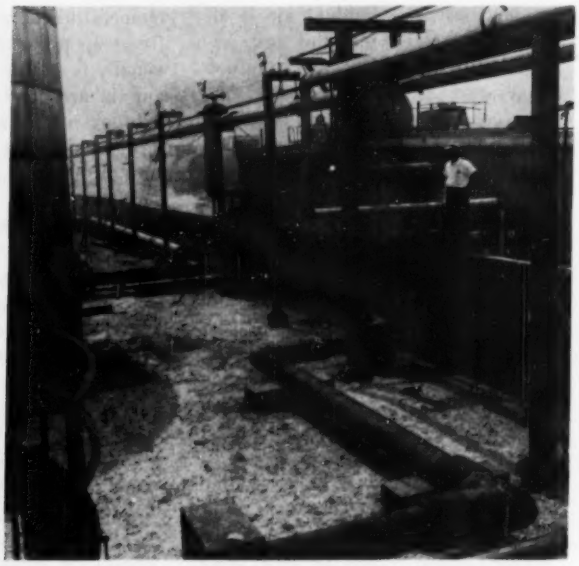
1 THE HEATED PITCH is first unloaded from tank cars into insulated pipes



2 IT IS THEN pumped to the pumping station through insulated pipes in conduits



3 IT NEXT leaves the pitch pumping station for the insulated and heated pitch storage tanks

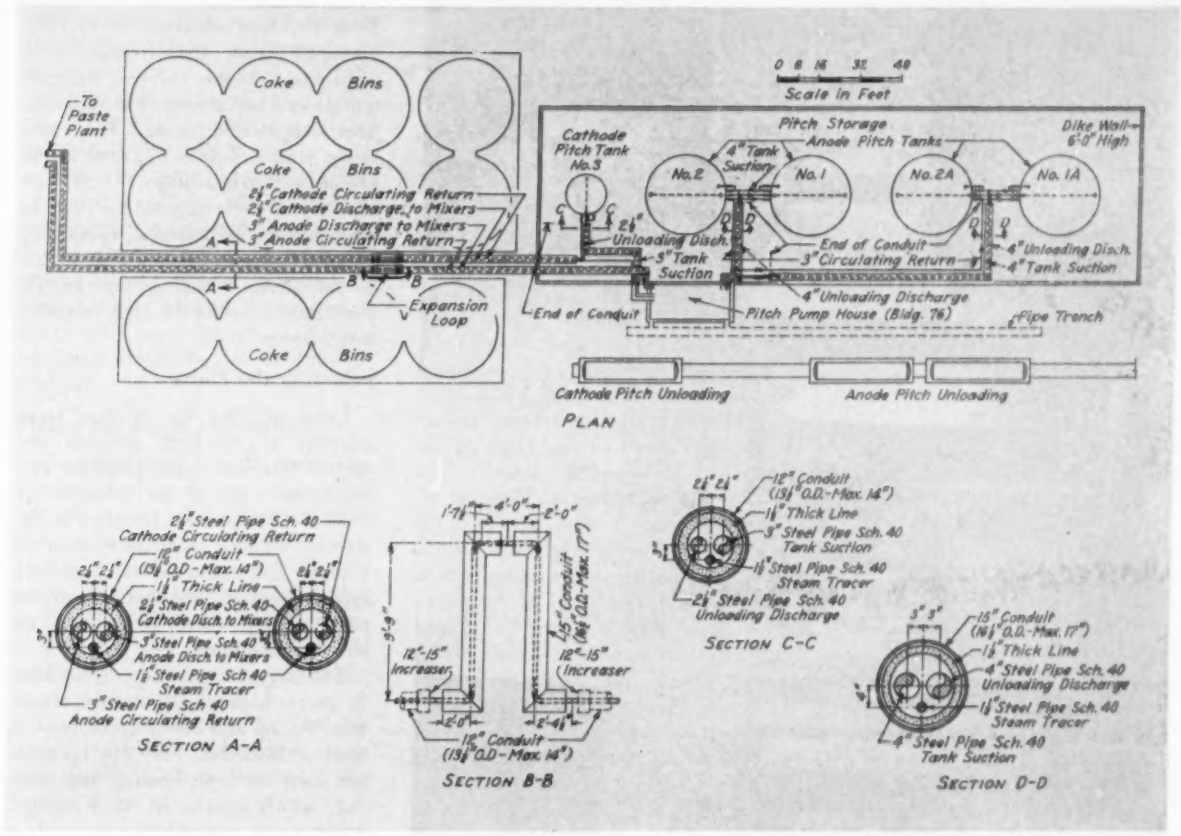


4 THE PITCH LINES and steam lines are supported and anchored above the ground

Insulated Pitch Piping

for aluminum reduction processing has many interesting features

By W. W. Pegram
Kaiser Engineers
Div. of Henry J. Kaiser Co.



5 PLANS AND DETAILS for part of the aluminum reduction plant piping system

INSULATED PIPING is used for transporting pitch from tank cars to storage and then to the paste plant in the largest aluminum reduction plant in the U. S. The annual capacity of this $150 million plant of the Kaiser Aluminum and Chemical Corp. at Chalmette, La., is 400 million lb of pig aluminum. There are eight pot lines — each containing 144 pots or electrolytic cells for processing the aluminum ore.

Insulated Piping in Conduits

Each pot is 11 ft, 6 in. wide and 21 ft, 6 in. long and is lined with carbon to serve as the cathode in the process. This carbon lining is recessed to hold the electrolytic bath which is made up of cryolite and alumina. The anode, composed of liquid carbon paste, is supported by a superstructure that rests on the cathode shell. When the anode is progressively lowered to maintain even immersion in the bath as the carbon is consumed in the continuous reduction process, the paste is baked by heat from the pot itself.

To keep the process productive, new paste is added from above at the desired intervals. This paste comes from a paste plant where coke and pitch are combined. The pitch is received at the plant in heated tank cars. The function of the insulated piping is to transport the pitch from the tank cars to storage and then to the paste plant at either uniform or elevated temperatures. The piping system for transporting the pitch as well as all other piping design in this plant complies with the requirements of the Code for Pressure Piping, ASA B31.1 1951.

The properties of the materials handled through these piping systems are:

For the anode pitch

a) Flash point ..... 345 F
b) Specific heat at 100 F ..... 0.54 Btu per lb per F
c) Specific heat at 300 F ..... 0.66 Btu per lb per F

For the cathode pitch

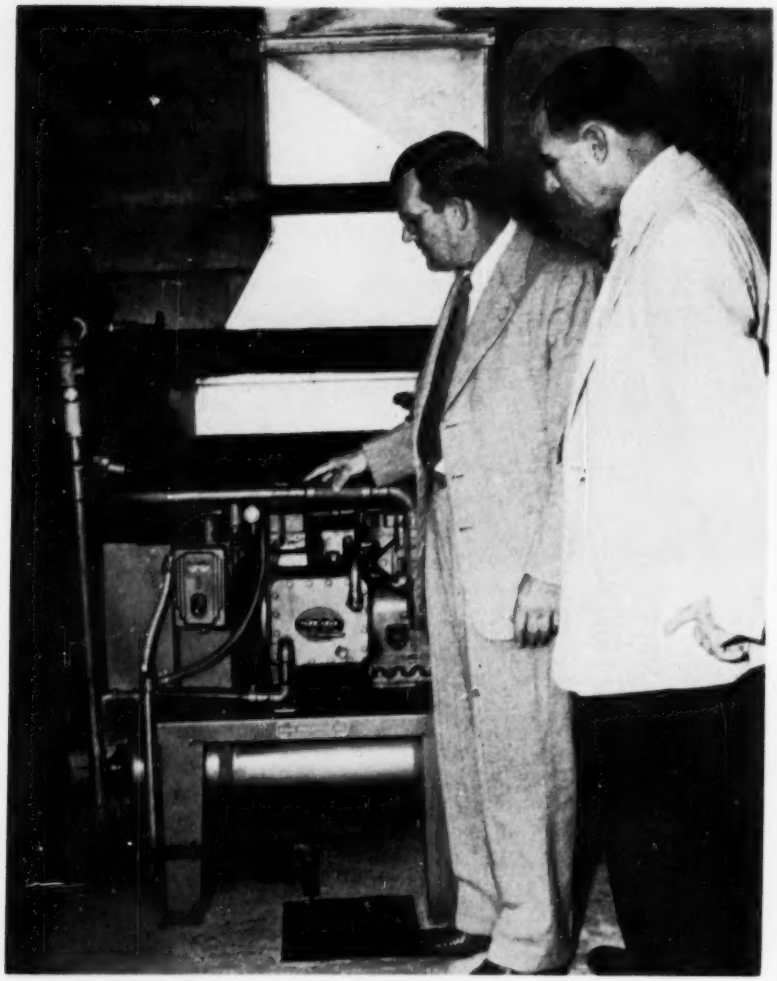
a) Flash point ..... 350 F
b) Specific heat at 100 F ..... 0.54 Btu per lb per F
c) Specific heat at 300 F ..... 0.66 Btu per lb per F

Each insulated conduit contains one pipe for the tank suction, one pipe for unloading the discharge and one pipe for the 150 psi saturated steam. The details of the engineering layout are shown in the accompanying drawing.

Prefabricated Fittings

It was estimated that up to 80 percent of the field work in this installation was saved by using prefabricated elbows, tee-branches, anchor units, gland seals and the expansion loops. Also, the prefabricated units are smooth and the ends are round, which permits positive field connections to be made quickly and easily.

A large portion of this pitch handling system has been in operation for more than a year without any trouble having been experienced. Approximately 78 percent of this piping installation is installed about 15 ft above grade and the other 22 percent is installed about 2 ft above grade. The system was designed by the Kaiser Engineers Div. of the Henry J. Kaiser Co.



EACH NEW SCHOOL is equipped with a number of 7½ hp self-contained heat pumps which extract heat from well water

Heat Pumps Go To School

Provide heating at reasonable cost as well as cooling in Florida schools

By Carl W. Millsom
Acme Industries, Inc.

SIX NEW SCHOOLS in Florida have established a new pattern in the mechanical equipment of such buildings by using refrigeration equipment to heat them. Operating costs of the systems compare favorably with oil heating, and the refrigeration capacity is of course also available for summer air conditioning. Four new high schools in this same area of Pinellas County will be similarly equipped.

Well Water Is Heat Source

Each of the schools has a number of 7½ hp self-contained heat pumps which extract heat from well water. Thus the heat obtained is literally "pumped from the ground" and transmitted to the building through hot water floor panels located in the floor slab of each room. The water is not wasted, but is returned to the ground through a disposal well. The capacity of the refrigeration units is such that the auditoriums, cafeterias, gymnasiums and other public rooms in the school buildings can be air conditioned during the high temperature seasons.

Selecting the Units

Units of 7½ hp in size were adopted as standard, because one unit of this size is adequate for one classroom wing of the schools. A total of 47 units were installed in the six new schools. Standardization on a single size meant that all parts are interchangeable, and that the service parts carried could be held to an absolute minimum.

The largest installation, in the 16th St. junior high school, includes seventeen 7½ hp and one 3 hp units — a total of 130.5 hp. Five 7½ hp units are used for both heating and cooling, which results in 45 F chilled water being available for use with a duct system. Thus, summer air conditioning is provided for the cafeteria and gymatorium.

Twelve 7½ hp and one 3 hp units were used in the classroom wings and in the administration building for floor panel heating only. In this instance, however, the piping was designed to accommodate separate room air handling units for future cooling. In other words, provision was made for air conditioning the entire building, at any time in the future, simply by adding the necessary air handling equipment.

Original Cost Reasonable

From the limited figures available, the cost of the original heat pump installations compares favorably with other modern automatic heating systems. The heat pump installations cost approximately 91c per sq ft, including the piping for the floor panel system but not including the cost of wells and water pumps.

Any comparison of first costs must consider the fact that heat pumps also provide air conditioning for portions of the building. Heat pumps serving public rooms where cooling

is required are equipped with a special automatic change-over valve to switch from winter to summer service.

While the individual heat pump sized for Florida heating requirements does not have enough capacity to cool the same area in summer, provision can be made to combine the capacity of several units to cool the auditorium, the library, and offices in the building. Where complete summer cooling is required in the entire area heated, additional equipment may be added for this purpose.

Operating Costs Favorable

On the basis of both theoretical estimates and practical experience, operating costs of the heat pumps in these schools, with an electric rate of 2c per kwhr, compares with automatic heating equipment burning fuel oil at 14c per gal. A comparison of operating costs for the heat pump with other methods of heating is given in Table 1.

The cost of heating the 74th St. school cafetorium with a heat pump was slightly over 2c per sq ft for the season. The operating costs for this unit during the 1952 heating season are presented in Table 2. The Gulf Beach elementary school, of similar construction and using modern oil-fired heating equipment, cost slightly under 2c per sq ft for fuel. At the 74th St. school, however, an additional amount of power was expended for testing at the beginning of the season. Under conditions encountered in Florida, it is therefore safe to assume that heat pump installations, with their attendant advantages, cost no more than other heating methods in common use.

TABLE 1—HEAT PUMP OPERATING COSTS compared with other methods of heating

Fuel	Rate per unit	Btu per penny from various fuels Btu per penny	Probable efficiency, percent	Net useful Btu per penny
Coal	$20.00/ton	13,000	60	7,800
Oil	14c/gal.	10,350	75	7,750
Gas	85c/M cu ft	11,750	75	8,800
Electric	2c/kwhr	1,706	100	1,706
Heat pump (70F water)	2c/kwhr	8,850	90	7,970
Heat pump (50F water)	2c/kwhr	7,450	90	6,700

Data compiled by Florida Power Corp.

TABLE 2—HEAT PUMP OPERATING COSTS for 1952 heating season—74th St. elementary school cafetorium

	Degree days	Kwhr used	Cost
October	24	196.6	$ 8.37
November	42	351.7	15.47
December	107	939	29.11
January	112	947	38.61
February	50	759.6	23.55
March	10	139	6.95
April	0	55.58	2.78

Equipment included one 7½ hp unit for heating and cooling cafetorium.
Data compiled by Florida Power Corp.

[Acknowledgement is given to the following for their cooperation in providing information for this article: Guy C. Hall, Florida Power Corp., A. Franklin Green, Chairman of the Pinellas County School Board, and Philip F. Kennard, Architect for the School Board. The installations were made by Jones, Inc., St. Petersburg, Florida.]

Prudential Building Sets Air Conditioning Records

THE PRUDENTIAL Insurance Co. of America building under construction in Chicago will be the largest completely air conditioned skyscraper in the midwest and the first large office structure in the city to have air conditioning included at the time of erection, according to Carrier Corp. The $3+ million contract for air conditioning and heating is also believed to be the largest signed for such a building at one time.

The new Prudential Mid-America home office will give Chicago two record-breaking installations. The Merchandise Mart, which is adding air conditioning equipment year by year, currently has the largest system in a commercial office building, it is believed.

With close to 1 million sq ft of floor space, the 41 floor Prudential building will have a complete year 'round system with individual room control using conditioned air circulated through the building at high velocities.

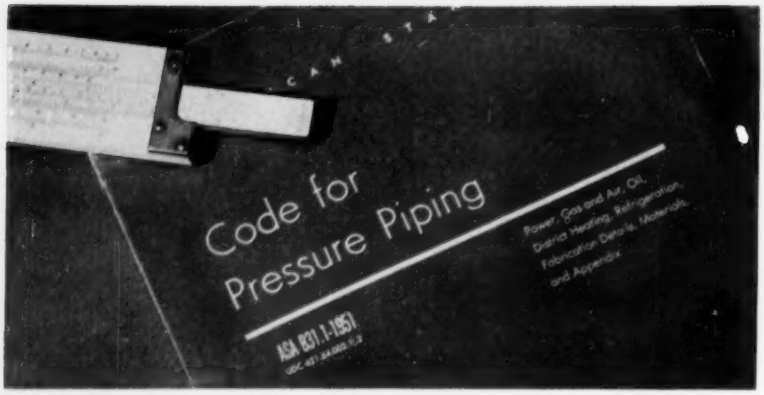
The major portion of the air conditioning plant for the building will be housed in an equipment room between the Illinois Central freight and passenger tracks, over which it is being constructed. It includes three large centrifugal refrigeration machines, each supplying 900 tons of capacity. In addition there will be three 75 ton reciprocating machines. One of these will be used for cooling the 41st floor observation tower and two for maintaining comfortable temperatures in the ground floor auditorium.

In addition, five self-contained air conditioning units will be installed to handle the extra heat loads from business machines. This self-contained equipment can be moved to other parts of the building with the business machines should this be desired at some future time.

Each of the 2628 conduit units in exterior offices is equipped with a control enabling occupants to "dial" their own temperature. Interior spaces will receive their conditioned air through some 3750 ceiling diffusers installed almost 100 to a floor. Some 836,500 cfm of air will be sent to all parts of the building through 25½ miles of conduit and duct. The fan horsepower will total 1590 hp.

According to Lyndon Lesch, of L. J. Sheridan & Co. (rental agent), the cost of the air conditioning and heating as estimated on the basis of a 15 year amortization period, allowing for the space required for the fan rooms, and including operation will be about 87¢ per sq ft per year. This cost of course includes the cost of heating and ventilation which would be required even if air conditioning were not installed. Also, the air conditioning permits use of windows which can be cleaned from the inside of the building at night, and it is believed that this will reduce window cleaning costs 40 percent. (The double glazed windows will swing on pivots, will be sealed with a pressure-inflated gasket.)

The engineers, architects and contractors for the building have previously been reported in HPAC.



Code for Pressure Piping

"Task Force" Reports on Piping Flexibility

An Addendum to the Report

The reason for publishing this addendum to the report of the Task Force on Flexibility of ASA Committee B31.1 is to acquaint the industry as a whole with these comments and proposals by D. B. Rossheim, of the M. W. Kellogg Co. The proposed alternate paragraphs for the code were published in the November 1953 HPAC in italics, to distinguish them from the text agreed upon by the Task Force as a whole.

UNTIL RECENTLY, the Code for Pressure Piping, ASA B31.1, has served merely as a standard of good practice, reflecting a consensus of the committee. In its application, many of its tenets have been loosely followed and deviations have appeared in individual company specifications as dictated by contrary opinions. With the approval of the code by the Canadian Standards Association and its adoption by several of the provinces, with the adoption of Section 8 by several states, and with the formation of a conference committee composed of enforcement authorities of the states and provinces, this piping code must now be regarded as a legally enforceable safety code. As such, its requirements are no longer simply a specification to be applied as agreed between the supplier and purchaser. Hence, the code must now be re-examined not only as to its intent, but also its wording must be subject to more careful scrutiny. It was with such thoughts in mind that the M. W. Kellogg Co. representative on the Task Force has advanced a minority opinion, which the committee has included in its report as an alternate.

Salient Differences

In the alternate paragraphs, the salient differences concern the matter of establishing by definite rules when flexibility calculations shall be mandatory. The previous draft of the piping code required "formal calculations . . . . only when reasonable doubt exists as to the adequate flexibility of the system". Mr. Rossheim holds that this wording, which was left substantially unchanged by the Task Force, is inadequate for a safety code and might result in controversy between the inspector, the manufacturer, the designer and the user. An inspection authority would obviously be in a position to demand an unwarranted amount of calculation or test work to be performed.

Accordingly, the alternate paragraph offers simple criteria to single out for detailed analyses the piping which is apt to give trouble because of thermal expansion stresses. Piping designers are invited to try these criteria and to consider their adequacy in the light of their own practice and experience. Reports of test calculations and suggestions for improvement are earnestly desired. The accompanying graph and sample calculations will facilitate use of the formula given in Alt. Par. 620 (c), which follows:

$$[DY]/[U^2(R - 1.05)^{3/2}] \leqq 0.03$$

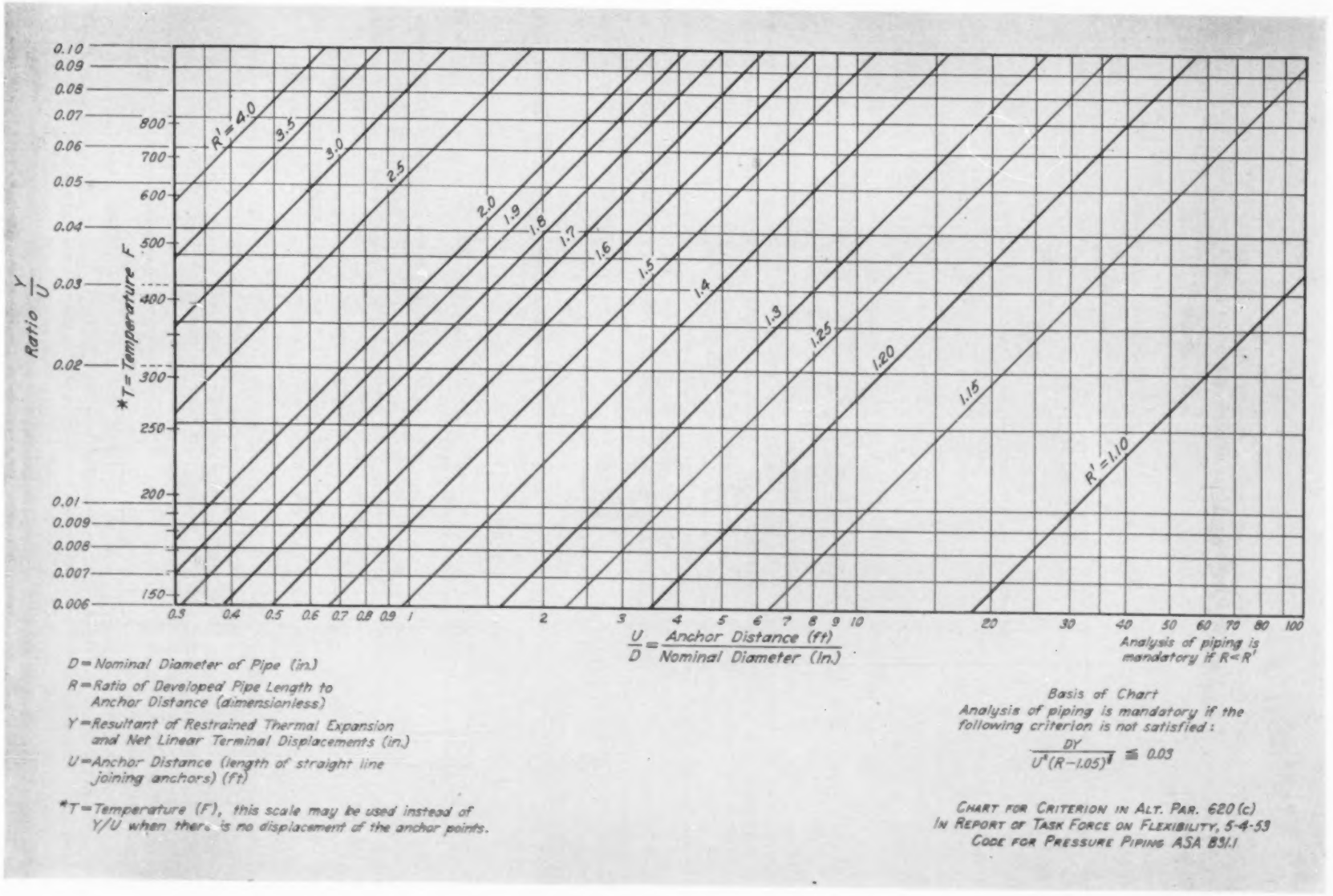
(The constants 1.05 and 0.03, as well as the exponent of 3/2, represent only approximate values, which will be subject to further investigation and correction as needed.)

D = Nominal pipe size, in.
Y = Resultant of restrained thermal expansion and net linear terminal displacements, in.
U = Anchor distance (length of straight line joining anchors), ft.
R = Ratio of developed pipe length to anchor distance, dimensionless.

Flexibility, Stress Factors

Another issue raised by the alternate rules concerns the requirements for the use of flexibility and stress intensification factors. Mr. Rossheim believes that the factors adopted by the Task Force should be required only for cyclic service, inasmuch as these factors have been based largely on the results of cyclic tests. It is granted that local stress intensification is highly significant in connection with fatigue but the contention is that an error arises in attaching the same significance when the service is non-cyclic. He takes particular exception to the use in non-cyclic service of the stress intensification factors proposed for tees, miter bends and flanges. Those on tees give results which are far too conservative for non-cyclic services, according to his experience.

In Alt. Par. 621 (c), limitation of combined pressure and expansion stress to 0.75 times the rated ultimate tensile strength of the annealed material at room temperature was pro-



D = Nominal Diameter of Pipe (in.)

R = Ratio of Developed Pipe Length to Anchor Distance (dimensionless)

Y = Resultant of Restrained Thermal Expansion and Net Linear Terminal Displacements (in.)

U = Anchor Distance (length of straight line joining anchors) (ft)

*T = Temperature (F), this scale may be used instead of Y/U when there is no displacement of the anchor points.

Basis of Chart

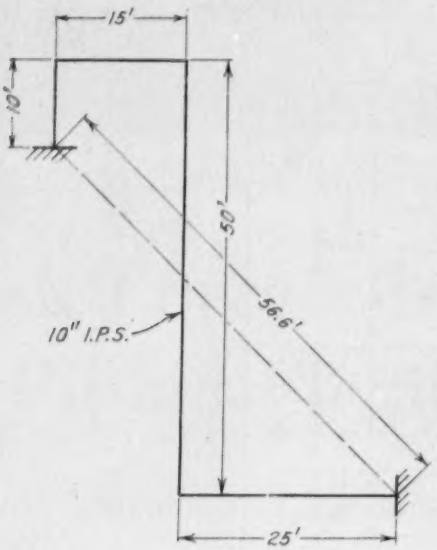
Analysis of piping is mandatory if the following criterion is not satisfied:

$$\frac{DY}{U^2(R-1.05)^2} \leq 0.03$$

CHART FOR CRITERION IN ALT. PAR. 620(c) IN REPORT OF TASK FORCE ON FLEXIBILITY, 5-4-53 CODE FOR PRESSURE PIPING ASA B31.1

SAMPLE CALCULATIONS, ALT. PAR. 620 (c)
AMERICAN STANDARD CODE FOR PRESSURE PIPING ASA B31.1
REPORT OF TASK FORCE ON FLEXIBILITY; MAY 4, 1953

Sample Calculation No. 1



Material – Carbon Steel

Temp. 650F

$D = 10''$

$U = \sqrt{40^2 + 40^2} = 56.6'$

$R = 100/56.6 = 1.77$

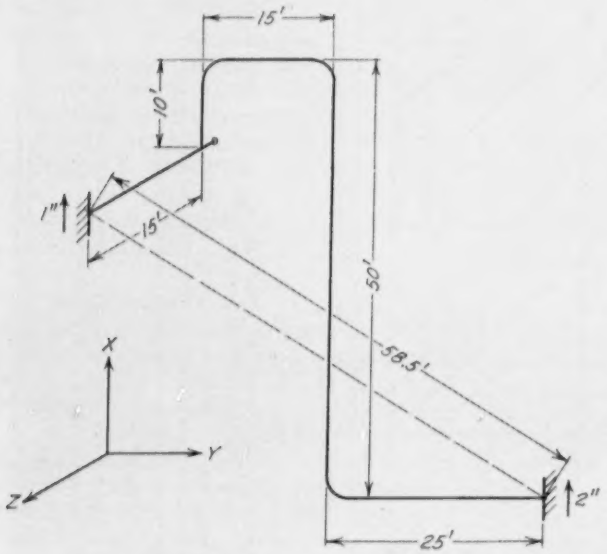
$U/D = 5.66$

From Graph, $R' = 1.50$

$R > R'$

Formal calculations are not mandatory under Alt. Par. 620 (c)

Sample Calculation No. 2



Material-Carbon Steel
Temp. 650F

Unit Expansion from 70F = 0.052 in./ft.

$D = 10''$

$U = \sqrt{40^2 + 40^2 + 15^2} = 58.5'$

Expansions and Terminal Displacements:

X-Direction	40×0.052	$= 2.08''$
Y-Direction	$40 \times 0.052 + 2 - 1$	$= 3.08''$
Z-Direction	15×0.052	$= 0.78''$

Resultant:

$$Y = \sqrt{2.08^2 + 3.08^2 + 0.78^2} = 3.8''$$

$R = 115/58.5 = 1.97$

$U/D = 5.85$

$$\frac{Y}{U} = \frac{3.8}{58.5} = 0.065$$

From Graph, $R' = 1.57$

$R > R'$

Formal calculations are not mandatory under Alt. Par. 620 (c)

posed so as to make unnecessary the exemption of gas, air and oil cross-country transmission piping from the rules. This paragraph follows:

Alternate Paragraph 621 (*c*), *as proposed by the M. W. Kellogg Co.*

(*c*) *The maximum combined pressure and expansion stress shall not exceed* 0.75 *times the rated ultimate tensile strength of the annealed material at room temperature. The maximum computed expansion stress* S_E *shall not exceed the following allowable value:*

$$S_A = f\,(1.25\,S_c + 0.25\,S_h)$$

f = Stress reduction factor to be applied for cyclic service. In the absence of more applicable data the values of f shall be taken from the table below.

S_c = Allowable stress (*S*-value) in the cold condition.

S_h = Allowable stress (*S*-value) in the hot condition.

S_c and S_h are to be taken from the tables in the applicable sections of the Code.

If the sum of longitudinal pressure and weight stresses is less than S_h, the difference between S_h and the sum of these stresses may be added to S_A.

Total number of full temperature cycles over expected life	Stress reduction factor f
7,000 and less	1.0
14,000	0.9
22,000	0.8
45,000	0.7
100,000	0.6
250,000 and over	0.5

Apart from the alternate proposals, the new rules contain many other features which will not be discussed herein as they are amply covered in the report of the Task Force [published in the November 1953 HPAC.] Attention is called to the increased stress range, the treatment of reactions, and the way in which cold spring is handled.

Comment Requested

Use of the proposed new section in either the original or the alternate form has been authorized for work currently performed under the code. It has been placed on a non-mandatory basis for the present. Final action is anticipated about March 1954. In the meantime, the committee would like to encourage the study of the Task Force report and have the rules applied in everyday work. It is requested that all comments and opinions be sent to the committee in care of L. W. Benoit, Secretary, ASA Sectional Committee B31.1, 420 Lexington Ave., New York 17.

Industrial Air Conditioning a Necessity — Not a Luxury

ONCE RESTRICTED to such specialized applications as textile and printing plants, industrial air conditioning is today a key contributing factor to the efficiency, health and safety of the production employee throughout industry, according to A. B. Waterbury, assistant chief engineer, Walter Kidde Constructors, engineers and builders.

"There are any number of popular-priced, mass-produced items presently on the market that owe their existence to the fact that—somewhere along the line—air conditioning played an important role in the manufacturing process," Mr. Waterbury said.

"Since many machine parts are now made under controlled air conditions, they can be assembled at some common point regardless of where they are produced. Fine and exact tolerances can be maintained regardless of plant location or weather conditions, and there are fewer rejects because of tolerances or corrosion on fine parts due to humidity. Also, laboratory testing and inspection can be based on standard air and humidity conditions."

Industrial air conditioning can be used successfully to boost the production unit of output per man-hour. However, the manner and extent to which it is applied to a specific industrial plant is largely dependent on the type of work. For instance, according to Mr. Waterbury, those who work seated at benches or at small machines, as in assembling small parts, inspecting finished parts or in packaging, require a larger amount of cooling in summer or heating in winter than employees who are on their feet or move about. He recommends that for employees seated at tables or benches, average conditions during the summer should be about 80 F and 50 percent humidity.

One of the most common causes of accidents at production equipment — outside of sheer carelessness and foolish "kidding around" — is the drowsiness induced by repetitive hand movements. The fresh atmosphere created by air conditioning has sharply reduced accidents and careless operation and has bettered production, he said.

Where volatile solvent vapors are handled, air conditioning is a necessity from the safety viewpoint. Where there are high concentrations of such gases, good practice requires two or three air changes per minute. If such vapors may be present in explosive proportions, the relative humidity should be increased to 55 or 60 percent, he stated.

To Study Snow Melting Cost, Performance

A SNOW MELTING system is being installed under the walk and under the driveway at the IBR research project just off the campus at the University of Illinois, Urbana. The system will be operated this winter to obtain data on cost of operation and general perfomance.

The same boiler which is used to heat the research home will be used to heat the water for the snow melting system. A heat exchanger similar to that used for the indirect heating of domestic hot water, but larger in size, will be installled. An anti-freezing solution will be used in the water which circulates between the heat exchanger and the coils in the sidewalk and under the driveway.

The system is so designed that the coils under the walk may be operated independently of the coils under the driveway. The system will be manually controlled.

In addition to providing valuable data on cost of operation, it is also expected that the project will supply information on the proper spacing of coils.

Started in 1940, the IBR research program has been instrumental in the development of new techniques for the improvement of hot water and steam heating systems. The applications of research findings to specific installations are outlined in a series of installation guides which are available at 50 cents each from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York.

Comfort Air Conditioning — When Is It Essential?

New Air Force method based on number of hours per year that wet bulb temperature exceeds 67 F

AIR FORCE REQUIREMENTS for air conditioning may be divided into six general categories, said William T. Smith, head of the refrigeration section of the U.S. Air Force headquarters, at the semi-annual meeting of the American Society of Refrigerating Engineers. They are:

1 Medical — surgeries, clinics, recovery rooms, critically ill patients' wards and certain specialized treatment rooms and wards.

2 Technical — manufacturing, processing, repairing and adjusting precision instruments, machine parts and equipment.

3 Operational — aircraft traffic control towers, photographic laboratories, telephone switchboard rooms and certain training classrooms.

4 Morale — theaters, service clubs, post exchanges and so called "Personnel Facilities".

5 Administrative — drafting rooms, court rooms, conference rooms, and executive offices.

6 Offices and quarters — only in those localities where the heat and humidity are so intense that air conditioning is required to maintain personnel efficiency.

However, the question arises: "When does the Air Force install comfort air conditioning?"

In an attempt to answer this question, the Air Force has approached industry with a similar question: "When is air conditioning for comfort absolutely necessary?" No complete answer to this question seems to be available, but it appears that the only reason an air conditioning installation is made for comfort is simply because the customer wants it and can pay for it. This, of course, is not considered as a valid reason by the Air Force for installing air conditioning. Accordingly, it was felt necessary to obtain a more practical formula.

Sweating through a day or so of excessive weather conditions is one thing, but when these excesses become a regular diet, the matter seems to justify some sort of corrective action. To judge where these excesses exist, it was finally decided to use 80 F dry bulb and 67 F wet bulb (50 percent relative humidity) as the datum point and determine how each Air Force base varied from these conditions. This point was selected for the simple reason that 80 F dry bulb and 50 percent relative humidity is the most commonly accepted condition for operating air conditioning systems. If the wet or dry bulb temperatures are exceeded, it would be uncomfortable and the duration of this discomfort would be a function of the total time these temperatures were exceeded.

The more this basis was studied, the simpler and the more effective its application seemed, and the next step was to arrive at a practical division of geographical areas into various groupings. In this way, the areas in which prolonged excesses were experienced would be given preferential consideration. A final and complete determination has not yet been made, but a possible grouping is given below.

A — Areas where the wet bulb temperature exceeds 67 F for 4500 hr or more per year.

B — Areas where the wet bulb exceeds 67 F for more than 3000 but less than 4500 hr per year.

C — Areas where the wet bulb exceeds 67 F for more than 1500 but less than 3000 hr per year.

D — Areas where the wet bulb exceeds 67 F less than 1500 hr per year.

Examples of how various cities fit into these groupings are shown in the accompanying table.

These studies are not complete but they will be continued in an effort to improve the data and its application. It may be that the method of comparing the degrees of discomfort of various climates is not entirely sound but there appears to be sufficient merit to warrant putting it into practice until some better criterion is available.

METHOD OF GROUPING to show comparative need for air conditioning

Group	Place	Hr per year that temperature exceeds: 67 F wb	80 F db
A	Canal Zone	8758	3762
	Puerto Rico	8317	2549
	Honolulu	6322	2161
	Manila	8069	3626
B	Tampa	4260	1984
	Mobile	3729	1780
	Shreveport	3229	1744
	Fort Worth	3093	1923
	Bermuda	3892	1370
	Okinawa	3944	2044
C	Atlanta	2510	942
	Washington	1744	575
	Omaha	1502	767
	Oklahoma City	2412	1487
	St. Louis	1873	919
D	Azores	910	25
	Chicago	1069	634
	Long Island	1287	400
	Seattle	49	190
	Spokane	42	323
	Ogden	27	674

Excessive Heat Costly

. . . and presents other hazards in industry. National Safety Congress is told. Safety in construction is also stressed

SAFETY involves many things — including protection against the hazards of heat

EXCESSIVE HEAT in various industries is accepted in too many cases as something that must be put up with, because we are all familiar with heat, said Theodore F. Hatch, Professor of Industrial Health Engineering, Graduate School of Public Health, University of Pittsburgh, in his talk on the effect of heat on the human body given at the 41st National Safety Congress. This acceptance of heat as a "contaminant" is puzzling when contrasted with how seriously an industry would consider some "strange exposure" — such as a new toxic chemical, for example.

As we become more and more concerned with human resources, we must do more to reduce the heat load on men in various industries, he said.

Several Zones of Heat

Many industries are finding it practical to air condition factories strictly for comfort, although usually industrial air conditioning is installed for the process itself — with human comfort a byproduct advantage. At the other end of the scale, there is the intolerable zone of heat, where it is a hazard to life. However, intolerable heat conditions don't exist in industry any more, he said, except in some emergencies.

In between these areas of comfort and intolerable heat, there are several areas, the boundaries between which are not well-defined. There is the "physiological area", where — for example — heat imposes a tremendous load on the individual's circulatory system. Next comes the "psycho-physiological area", where too much heat stress may increase accidents, reduce efficiency in skilled work, and increase errors. In the next — the "psychological area" — too much heat will reduce efficiency, increase absenteeism, increase labor turnover, and create irritation and discomfort.

Plant health and safety officials are primarily responsible for correcting the physiological area conditions, regardless of cost. In the psycho-physiological area, engineering must decide how far to go in handling the problem, as production costs are involved. Because of the effects on indirect production costs and losses, management and the personnel department are primarily concerned with correction of conditions falling within the psychological area, he stated.

As men get older, their ability to withstand excessive heat drops very sharply, he said. However, older men "have learned to live with excess heat," and govern their activity accordingly.

Processes Create Problem

A hot, dry condition is not as dangerous as a warm, moist one, he pointed out. It is also necessary to distinguish between natural heat and humidity conditions, and those created by the industry itself. There are not many places in the world where climate stresses man to a dangerous degree. Many heat problems are created, however, because hot processes are carried on in the wrong types of industrial buildings.

"We are accepting heat in industry to a degree which we should not," he concluded. All ways of solving the problem should be investigated and utilized, he advised.

At the same session, Bartlett R. Small, Staff Engineer, Mechanical Engineering Dept., Aluminum Co. of America, presented an extensive discussion of methods of heat relief in industry — particularly the use of reflective screens to reduce the amount of unwanted radiant heat on workers. An extensive paper by Mr. Small on this subject appeared in the October and November 1952 issues of HPAC.

Unfavorable working conditions may be caused by radiant heat or hot air around furnaces, kilns, heat treating rooms, etc. To make workers more comfortable, one of three methods can be used, he said — a high rate of ventilation, reflective shields or spot cooling.

Shielding and insulation are the only ways to control radiant heat. Ventilation and air conditioning, including spot cooling, are the only control methods for hot air.

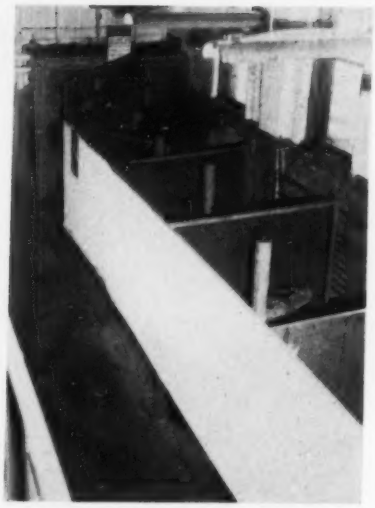
Plan Safe Construction

Engineers plan the elements that make the design of any structure safe. So must contractors plan the elements that will make its construction safe, said Dale Medsker, of the National Surety Corp. This would make buildings just as safe for workers during construction as they are for occupants after completion.

Application of engineering principles to construction work involves three simple steps. "First, contractors must plan their jobs in every detail and make safety a part of the plan. Second, work must be performed in a manner consistent with sound engineering principles. Third, failures and accidents must be analyzed so that corrective action can be taken."

Training Pipe Welders

By R. D. Berry
Certified Welding Bureau for the Piping Industry



PIPING CONTRACTOR'S shop used for welding classes

Journeymen pipefitters learn welding under program developed through cooperation — for the benefit of the entire piping industry

MANY CHANGES and a great deal of progress have been witnessed in the method of installing piping systems during the past 30 years. Perhaps the most important of these has been the growing tendency toward the use of gas and metallic arc welding for making joints. While a number of welded pipe installations were made during the first half of this period, it was not until about 1934 that this method of construction became popular.

In 1935 it became necessary to train a large number of qualified welders when the Federal Housing Authority specified that welded joints be used on all piping. There were few journeymen pipefitters at the time that were able to weld, and the training of qualified men became an expensive undertaking for the contractors and the public. The demand for welders was acute and a chaotic condition developed due to the shortage.

Training Program Begun

The heating, piping, refrigeration and air conditioning contractors of Illinois decided upon a course of procedure to be followed in training pipefitters to be welders which they thought would be efficient and reflect a considerable saving to the contractor and the public. After a discussion with government officials in charge of federal housing work, it was decided that a group of pipefitters should be trained and tested so that they could weld successfully and in turn would be qualified to perform this work.

Arrangements were made with a heating and piping contractor for the pipefitters to be tested in his shop after their course of instruction, and the first nine pipefitters were qualified as gas welders on November 23, 1936. On December 18, 10 more were added to this list, and by January, 25 men were capable of performing this work. The initial tests were extremely costly, as many prospective pipefitter welders failed to qualify, and considerable difficulty was encountered in securing men who were acceptable.

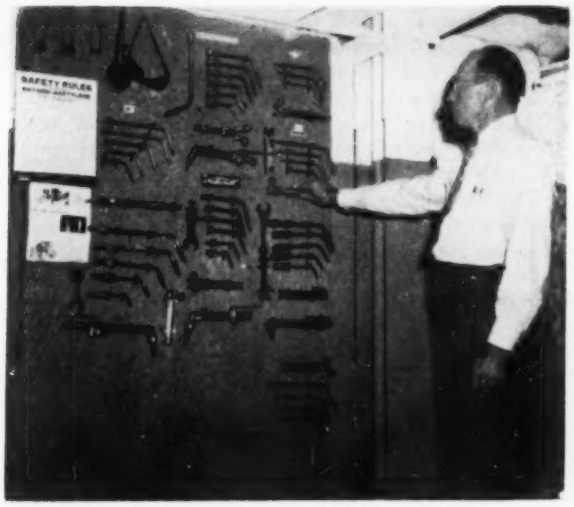
Group Examinations

During the progress of training welders to comply with the requirements of the federal housing program, it became apparent that a more comprehensive training course should be started which would also meet with the approval of insurance companies, other government agencies, etc. A group of 15 contractors cooperated in developing a more rigorous course of instruction and examination on gas welding. On December 10, 1936, approval was secured from insurance and other agencies on this advanced procedure and final arrangements were made for testing the welders in a group. Three operators were qualified on June 10, 1937, eight on June 24 and 12 on July 20. By October 13 a total of 21 were qualified at an expense of $3450 — an average cost of only $165 per man. In July, 1938 a few pipefitter welders were tested for metallic arc welding on an approved specification. These men were all tested under the supervision of the Hartford Steam Boiler Inspection and Insurance Co. Due to the progress made in the training of journeymen as welders, some large operations were completed without delay by piping contractors who had employed some of the pipefitter welders trained in this program.

Program Expanded

In order to broaden the scope of this training program and serve the public to better advantage, it was decided to form an agency whose duty it would be to advance the art of welding, and to educate and qualify competent pipefitters as welders for its members. As a result, on October 24, 1940, the Certified Welding Bureau was incorporated under Illinois laws with a membership open to any firm or individual engaged in the pipefitting industry. The expense of operating the bureau and conducting its affairs was to be pro-rated among the members.

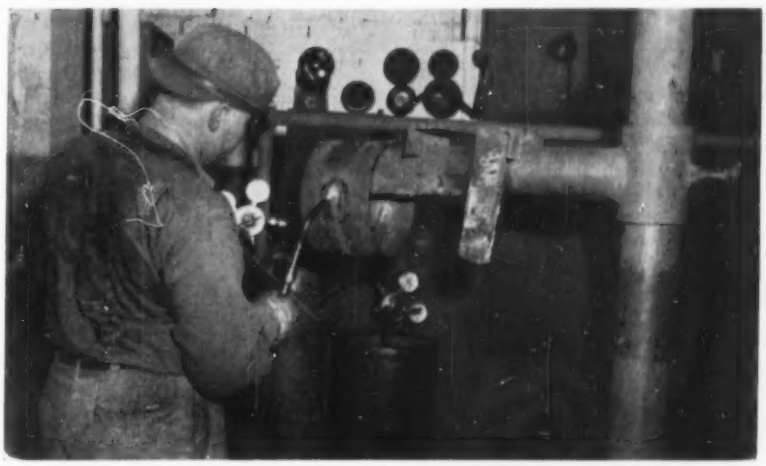
Mr. Berry, president of Gallaher & Speck, Inc., mechanical contractors, received the distinguished service award this year from the Heating, Piping and Air Conditioning Contractors National Association for rendering distinguished service to the association and its members by developing better labor management relations, by contributing to the growth of apprenticeship and in the establishment of economic methods of control of pipe welding.



INSTRUCTOR EXPLAINS tools and equipment for gas welding

METALLIC ARC WELDING equipment available for instruction

The training program for welders was revised and tested on February 26, 1940, under Hartford Steam Boiler and Insurance Co. supervision. Operator tests followed and by the end of 1940, a total of 176 men were qualified. By the end of 1941, 427 had been qualified; and by the end of 1942 — 623; by the end of 1943 — 748; and up to June 1, 1944, the bureau had qualified 752 welders — 474 for metallic arc process, 265 for gas, and 13 for metallic arc process welding with carbon-moly pipe.



JOURNEYMAN PIPEFITTER taking welding examination after instruction

National Bureau Formed

In 1943, at the convention of the Heating, Piping and Air Conditioning Contractors National Association, the question of a national welding bureau was discussed and a committee was appointed to develop a plan for this bureau. Following the report of the committee, rules were adopted by the board of directors in November, 1943 and the National Certified Pipe Welding Bureau came into existence. The first chapter to join this bureau was Chicago and since then a number of cities have been issued charters. The purpose of this bureau is to carry on, on a national basis, along the same lines that have been successfully pursued in Chicago, the aim being to secure as many firms as possible to adopt the national procedure and to qualify as many journeymen under this procedure as required for the industry. Membership in this bureau is not

WELDED SAMPLES used in the examination of pipefitter welders

restricted and is open to any individual or organization regularly engaged in the pipefitting industry.

Cooperation Between Groups

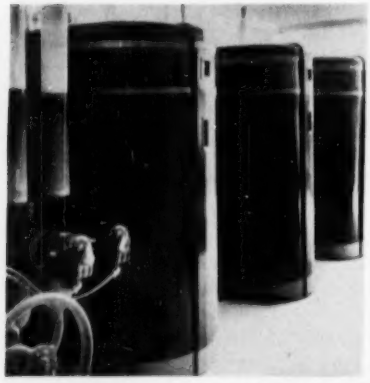
During the operation of the Certified Welding Bureau in Chicago, considerable cooperation has been extended by local 597 of the United Association. This organization agreed with the Heating, Piping and Air Conditioning Contractors Chicago Association not to permit the journeymen to weld unless they were qualified to do so, and the Chicago association agreed to test any journeyman required for welding. This arrangement was not planned in any way to restrict the activities of the journeyman, as the Chicago association thoroughly understood that a regular member of the union was not to be restricted in any of his duties, but these limitations were for the protection of the public, the union and the contractor.

It was decided that a policy requiring that the work be first grade would encourage the public to accept this method for doing the work and would not result in the discredit of the contractor or the journeymen. The contractor would not be able to determine the quality of the journeymen's work, however, without a thorough test. As yet there has not been a way developed to determine the qualifications of any journeyman except by test. The Heating, Piping and Air Conditioning Contractors Chicago Association had a further agreement with the local union that no contractor should perform any welding unless he was a member of the bureau or unless the journeyman he proposed to use for this welding had been tested under this procedure. The union further agreed that as long as the journeyman was employed by one of the members of the bureau or some other organization that had had tests made, the journeyman was not to be removed to some other organization who had not gone to the trouble and expense of having tests made and the pipefitter welder qualified.

The welding bureau is not identified as an integral part of the Heating, Piping and Air Conditioning Contractors National Association or any of its local associations, nor is it a part of the United Association of Journeymen Plumbers and Steamfitters. The bureau is a complementary adjunct to both the employers' and employees' groups and is a method of getting the cooperation of the various insurance companies so as to make possible the interchange of pipefitter welders qualified for insured work and welding procedures. If there are any other known ways to obtain this cooperation, through the union or any other source, we are not aware of them. The complete success of the various welding bureaus depends on the wholehearted cooperation of all the interested factions, and we believe that these welding bureaus are an unselfish contribution to a sound public policy.

Our welding procedure, under which these men are trained, is a part of the piping industry's nationally accepted apprenticeship curriculum and has been approved by both of these groups. It is felt that whereas "in union there is strength" — in cooperation there is power and stability for the entire piping industry.

11 Small Boilers Heat School



THE MULTIPLE installation of 11 oil fired boilers is in three separate locations, in banks of four, four and three

THE APPLICATION of a multiple unit installation of residential oil fired boilers for heating large commercial, industrial and public buildings is being demonstrated in the new Worcester county senior high school in Maryland, where 11 such hot water boilers have been placed in operation. The school, completed this summer, has a capacity of 700 students and is just outside Snow Hill, the county seat.

It is a single story building with three wings. The 11 boilers are installed in three separate locations in banks of four, four, and three, with each bank serving a separate wing.

The system is zoned for maximum comfort at a minimum fuel cost. Simple controls provide individual temperature control regardless of the sun load, occupancy or exposure of the wings. On the many evenings when only a part of the school is in use for special functions, only the boilers serving that part need to be put into full service. Thermostatically controlled, the boilers in each bank cut in automatically as the demand for heat increases and cut out as it decreases. Thus, on a mild day, only one boiler in each wing may be in operation.

Advantages of the scheme are said to include an initial cost advantage of some $3000 over a more conventional installation, the fact that no high chimney is needed, the minimizing of the effects of a breakdown in severe weather, the opportunity to service one unit without a complete shutdown, and the ease of installing additional units for future expansion.

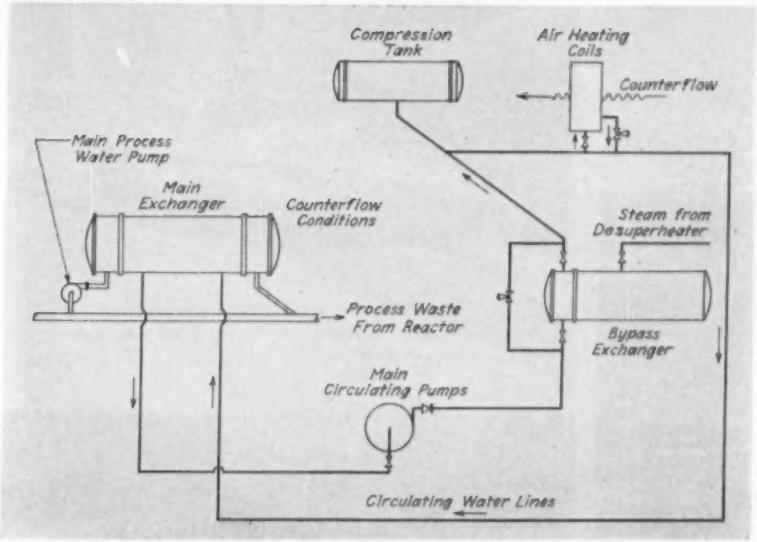
O. E. Wilson & Son made the installation. Finney, Wolcott and Associates were the architects.

One of the first installations of this kind — 120 oil-fired boiler units in 24 groups of five each — was made at Mount Holyoke College and was described in an article in the November 1934 HPAC.

[Photo courtesy General Electric Co.]

College Gives Students List of HPAC Articles

THE MECHANICAL engineering department of California State Polytechnic College, San Luis Obispo, recently mimeographed for its students a listing of the numerous articles on methods of making piping flexibility analyses published in recent months in HPAC. The library of the college furnishes photostats of the articles to its students on special request.



THE HEAT RECOVERY system has three major elements, as indicated in this flow diagram and explained in the text

Heat from Atomic Reactors To Heat Buildings at Hanford

LARGE QUANTITIES of waste heat developed in atomic reactors at the Hanford plutonium-producing project, Richland, Wash., of the Atomic Energy Commission are going to be put to use for the first time in this country for heating buildings. [Some information about the "atomic heating plant" in England appeared in the January and September 1952 issues of HPAC.]

This practical industrial use of the excess heat will be achieved by indirectly using water carrying away reactor heat to warm the air drawn into certain plant structures now under construction. The system was designed by engineers of the General Electric Co., which operates Hanford for the AEC, and the Charles T. Main firm of architect-engineers.

Actually, several buildings will be heated by one system, but about half the heat will go into the main structure housing a production reactor, now under construction.

Enough heat to take care of the needs of a thousand average sized homes will be extracted from the reactor cooling water and transferred to the air going through plant air conditioners.

The initial investment for the heat recovery system is estimated at about $614,000, and annual operating cost, excluding repairs, at about $2200. The estimated fuel saving of $59,000 a year would pay off in about 7½ years the $444,000 of the initial cost of the heat recovery system that would be additional to the cost of a conventional steam system.

As explained by the designing engineers, here is how the system will work:

Water from the Columbia river is pumped through the reactors where plutonium is made by the transmutation of uranium. The water absorbs immense quantities of heat generated by the process. On its trip through the reactor, dissolved mineral matter in the water becomes slightly radioactive.

Because of this factor, the water from the reactor will be run through a heat exchanger to warm up the water in a secondary piped circuit that will relay the heat to an air conditioning system in the building, while the radioactive water is carried away. This activity quickly dies away by natural decay, but the concentration of large volumes would create a radioactivity hazard to the plant areas before being harmlessly dissipated in the main stream of the Columbia.

To prevent the movement of contaminated dust particles from the reactor to working areas, a constant flow of air is maintained across the reactors to the outside.

Consequently, no air is reheated and recirculated in the building. Instead, a large volume of air is pumped in from the outside, cleaned, heated and poured into the building.

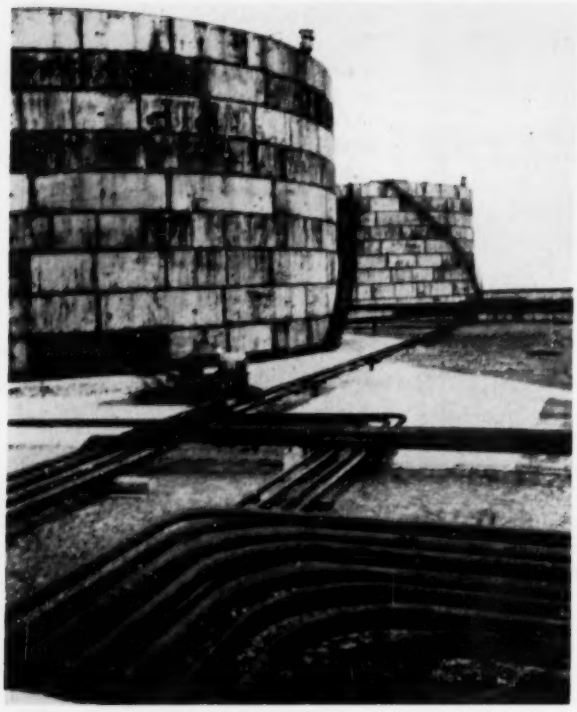
To pipe the water direct from the reactor through coils in the floor or walls to warm the building by radiant heat would be impractical because of this large volume of outdoor air constantly moving in.

The heating system itself is simple in both concept and in execution. It consists of three major elements connected by an appropriate system of piping — (1) the primary exchanger, which transfers heat from the effluent stream to an intermediate fluid; (2) the secondary exchangers, which transfer heat from this intermediate fluid to the air; and (3) a bypass exchanger, which is arranged to provide adequate heating when the reactor process is shutdown.

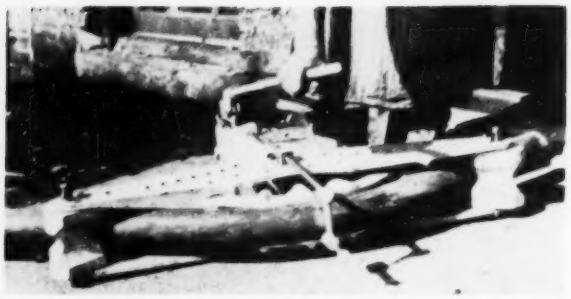
The bypass exchanger is supplied with steam from a central station plant when called on to perform. The primary purpose of the steam plant is to supply emergency electrical energy to the plant in the event of a power outage. No extra capacity for heating is considered in installing the steam generators.

A network of piping connects the various process buildings with the primary heat exchanger. This piping is all subsurface and is not insulated, as the primary heat source is both abundant enough and at sufficiently low temperature so that losses to the ground will be considered negligible.

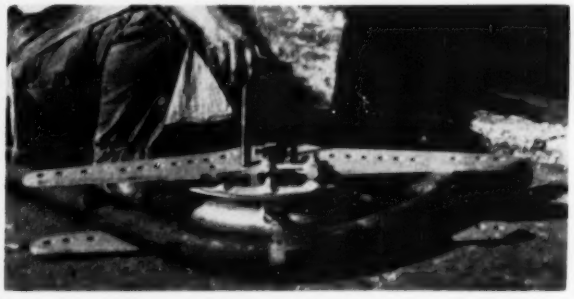
The huge reactor process plants at Hanford have been creating vast quantities of waste heat since 1944. This heat, which is a necessary byproduct of the nuclear reactions involved in converting uranium to plutonium, has been of great interest to engineers, who have looked forward to its industrial application.



THE UNOBSTRUCTED FLOW and the simplicity of installation is shown by the streamlined appearance of these symmetrical bends



NO MOVING of the pipe was necessary with the pipe bending machine. A 45 deg bend was made in one operation



AFTER THE BEND was completed, the pipe was pushed out of the shoe with the push-out pin and ready for installation

Benders Speed Piping Job

Also save materials, simplify installation

By Wilmer R. Schuh

Chief Engineer
E. D. Wesley Co., Contractors

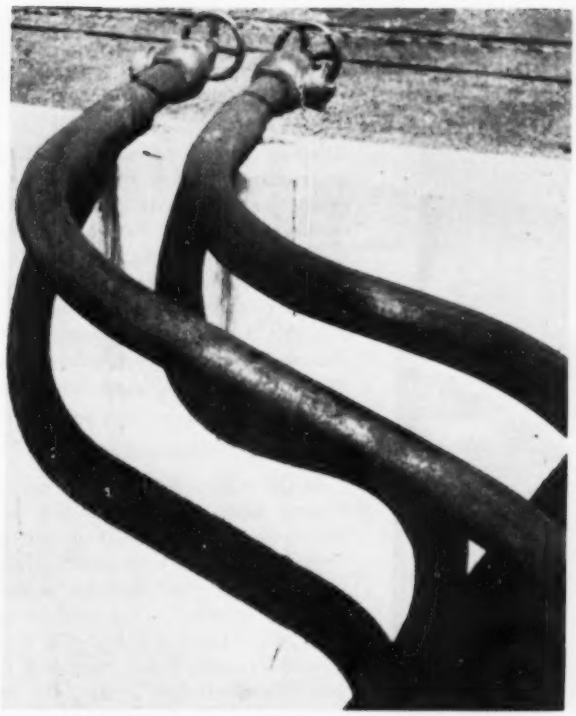
INSTALLING 22,074 ft of pipe in connection with four oil storage tanks 10 days ahead of the 90 day contract time resulted in a saving of 270 man hours. In addition to this, over $800 in materials were saved by using pipe bending machinery. This project was finished last December for the Wisconsin Petroleum Terminals Inc., in Milwaukee.

When the piping contract was awarded for this $1½ million project consisting of four tanks — three of them 185,550 cu ft, 75 ft in diameter and 42 ft high, and the fourth 268,292 cu ft, 90 ft in diameter and 42 ft high — it was decided to use pipe bending equipment. The decision was based on our 10 years of pipe bending experience. We used pipe bending machinery with half circle shoes and a long ram, and identical bends could be made in one setting for any degree up to 180 deg in just a few minutes.

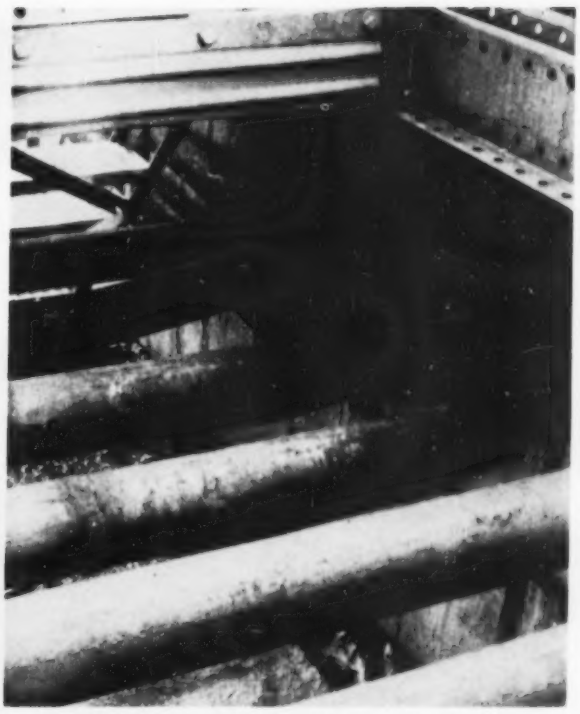
The bending operations were concentrated on the 10,020 ft of 4 in. pipe and the 3983 ft of 3 in. pipe — both of which are used as foam lines extending from the central foam house to the tanks for fire prevention — and the 1234 ft of 4 in. product line pipe used to load tank cars. Bends were also used on the 380 ft of 2 in. product lines. Altogether, about 135 bends were made from 90 deg down to 12 deg along with 32 offsets — eight on the 4 in. pipe and 24 on the 3 in. pipe. One of these was a 40 ft length which was bent in a rolling offset of 15 deg and 90 deg. At the other extreme, bends were made in pipe that was only 4 ft in length.

Time and Costs Reduced

One of the features about using pipe bending machinery which ap-



OFFSETS IN PIPING were easily made by bending the pipe. The installation of these offsets was easily accomplished after the bending



PIPE INSTALLATIONS with close tolerances — such as this one — lend themselves to the use of pipe that is bent

pealed to us was that there was no limit in the direction of bending or in the offset which could be made. The resulting savings that were experienced are obvious.

We estimate that our savings on the 3 in. and 4 in. bends came to about 75 percent. We figure the cost of a 4 in. 90 deg bend was only $3.00 — $2.00 for labor and $1.00 for the pipe. For the 3 in. pipe, the cost of the bend was only $2.50 — $1.90 for the labor and 60¢ for the pipe. For a 45 deg bend, the cost was about $3.00 for the 4 in. pipe and $2.50 for the 3 in. pipe.

These costs are computed on the basis that 45 minutes was required to set up and measure 4 in. pipe for a 90 deg bend while the bending time was two minutes. The setting up and measuring time for a 90 deg bend in 3 in. pipe required 35 to 45 minutes, with about one minute for the bending operation.

The cost figures given are based on the use of a bender which does not require moving the pipe during the bending process, and which has a bend indicator.

We think that pipe benders can best be utilized at the job. The cost is relatively low for bending on the site, as illustrated by the fact that two men can set up, measure, make and install six 90 deg bends in 6 in. pipe in eight hours at a cost in labor of about $50.

There is still another saving made in bending pipe besides those mentioned previously. The salvage rate on what would otherwise be scrap pipe is almost 100 percent.

In this installation, the pumps operate at a pressure of 75 psi in connection with the 4 in. product lines used to load tank cars. This pressure is more easily maintained by the lower resistance of bends by virtue of their smooth walls. These smooth walls also decrease the turbulence of the flowing oil, which in turn reduces the resistance to flow.

[Photos courtesy Tal Bender, Inc.]

Seeks Support for Air Pollution Study

SUPPORT FOR A one year study to determine the source of air pollution in the Chicago area was one of the goals of the Midwestern Air Pollution Prevention Association's fall meeting at Gary, Ind., last month. The association hopes to stimulate financial interest in a $25,000 study to be conducted by the Armour Research Foundation of Illinois Institute of Technology.

The MAPPA and the foundation are trying to explode the fallacy that dirt is a sign of prosperity, according to Dr. Walter C. McCrone, senior chemist at the foundation. He asserted that cities can be as clean as the country. Furthermore, he added, a large share of the necessary improvement would be feasible, practical and economical.

"The problem cannot be isolated to one or two cities," he said. "What happens in one community is of vital interest to the next."

Predicts 1 ½ Million Room Units in '54

ROOM AIR conditioner sales will soar to 1½ million units in 1954, Bernard A. Mitchell, president of the Mitchell Mfg. Co., predicts.

Mr. Mitchell says homes and apartments account for 76 percent of room air conditioner sales, with the rest going to offices, factories, hotels and motels.

Humidity Control Improves Operation of Business Machines

By W. N. Kitchen
Assistant Chief Engineer
Kellogg Co.

ELIMINATION of curling and stretching of punched cards has turned out to be a very important byproduct of the air conditioning system in the Kellogg Co. offices at Battle Creek, Mich. The primary objective of the system was to provide personal comfort.

High Humidity a Problem

The problem of the automatic business machine cards stretching and curling was caused by the moisture absorbed by the cards from the damp air. Considerable difficulty was experienced in the operation of these automatic tabulating machines during periods of both high and low humidity. When the relative humidity was high, the cards increased in size and they curled and softened to the point that the machines could not handle them. It was then necessary to drive out the moisture absorbed in them with heat to restore the cards to their original size and condition. During low humidity periods, the cards lost moisture, decreased in size and became hard and brittle — at very low humidity conditions static electricity was even developed. However, high humidity conditions presented the greatest problems in the operation of the machines.

Moisture Reduced

A system to provide humidity control was designed to maintain the following conditions in summer: 75 to 80 F dry bulb and 45 to 50 percent relative humidity; and in winter, 72 to 75 F dry bulb and 30 percent relative humidity. The humidity control in the summer is obtained by passing all of the incoming outdoor air through chemical conditioning equipment which reduces the moisture content of this air to about 35 grains per lb. The mixture of this dry air with the recirculated air provides the relative humidity control within the ranges specified. The ratio of outdoor air to recirculated air is about one to three. The chemical absorbent used in the equipment is a solution which is largely lithium chloride.

Winter Humidification

In the winter the chemical conditioning units are not operated, but the same ratio of outdoor air to recirculated air is maintained. However, during the heating season moisture is added to the outdoor air and recirculated air by grid type humidifiers which are regulated by humidity controllers. Also, the air is heated as it passes through steam heating coils.

Since installing the business card machines in these controlled atmospheric conditions, all of the curling and stretching troubles with the cards have been eliminated. It has been found desirable of course to also control the conditions of the card storage area. If the cards are not so stored, a period from two to four days is required in the conditioned area to prepare them for the best machine operation.

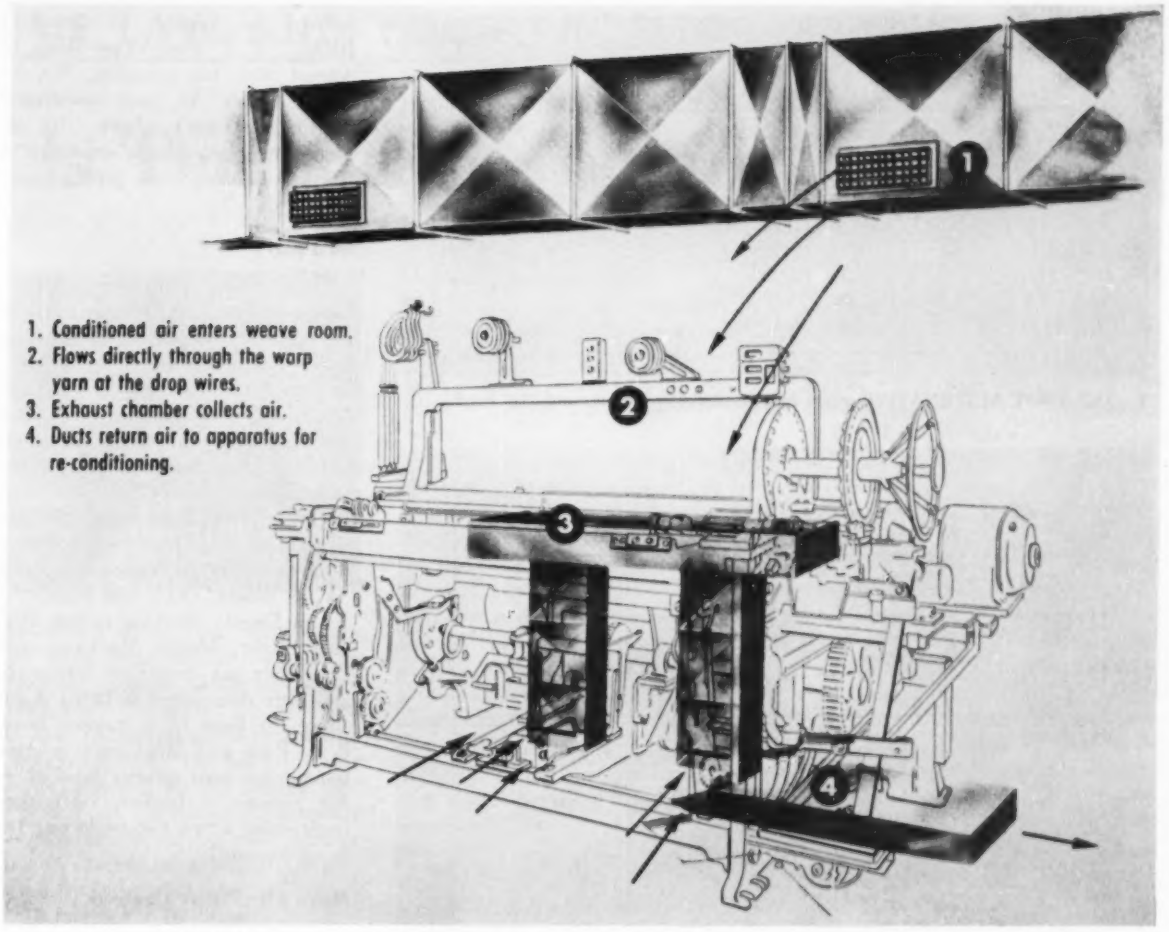
The humidity control system was designed by Giffels and Vallet, Inc., L. Rossetti, Engineers and Architect, and has been in use for over three years.

[Photo courtesy of Surface Combustion Corp.]

Estimates Cost of Leaks at $2 Billion a Year

LEAKS COST the country $2 billion a year. These wasted dollars dribble out through mechanical connections and gaskets and leaks in water, air, gas, oil and vapor tanks, fixtures and pipes, says C. A. Benoit, Jr., president of the Permatex Co.

"This needless toll taken by leaks adds up to one of the costliest overall maintenance expense items faced by U.S. industries and consumers," says Mr. Benoit.


1. Conditioned air enters weave room.
2. Flows directly through the warp yarn at the drop wires.
3. Exhaust chamber collects air.
4. Ducts return air to apparatus for re-conditioning.
1
2
3
4

PART OF THE air conditioning system is integral with this new loom for weaving cotton cloth

New Loom Air Conditioned

. . . for efficient weaving operation

A NEW APPROACH to the problem of air conditioning was required to obtain efficient operation of an improved loom recently demonstrated in New York. An entirely different method of weaving cotton cloth made it necessary for the air conditioning system to be specially designed.

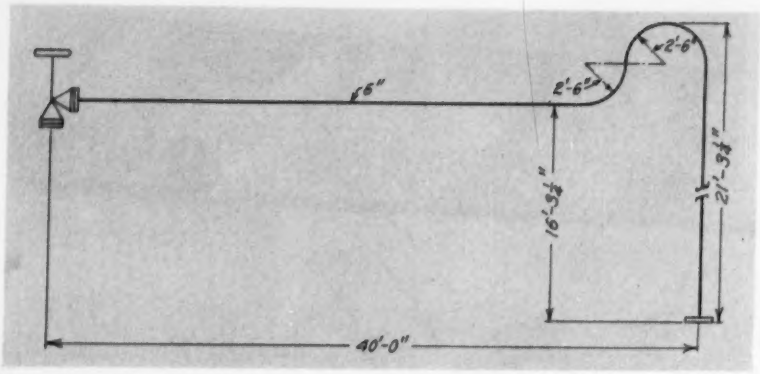
How Air Circulates

The system delivers conditioned air to the room through rectangular ductwork shown by the arrows in the illustration. This air flows directly through the warp yarn at the drop wires on the loom designated by the numeral "2". An exhaust chamber directly under the drop wires collects the air, and it is returned to the apparatus by means of ducts under the floor shown by the numeral "4". At the apparatus room the return air is thoroughly cleaned by automatic filters before being exhausted or returned to the room.

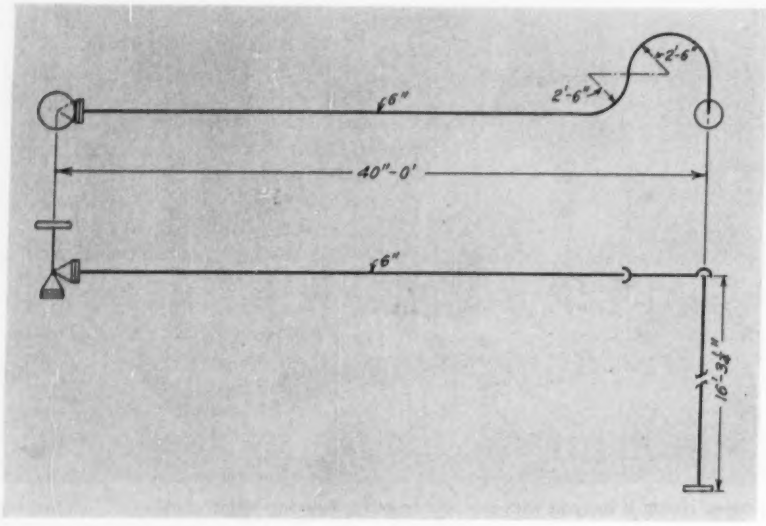
The inclusion of the exhaust chamber as a part of the loom itself is based on the principle that the cleanliness and proper moisture content of the cotton warp, with resulting tension regularity for best weaving, can best be accomplished by proper control of air conditions at the loom.

The air conditioning system to be installed will maintain a temperature of 80 F while the relative humidity is to be controlled at 70 percent. In addition to the increased efficiency obtained in the weaving process, the room remains sufficiently dry to prevent sticking of lint and greatly reduces cleaning problems.

An article describing all the details of this new air conditioning system that is being installed in the plant of Borden Mills Co. at Kingsport, Tenn., is to be published in HPAC. — R. M. ANDERSON, The Bahnson Co.



1 THE FIRST ALTERNATIVE might be a combination quarter and "U" bend



2 IF LIMITED headroom would preclude the design in Fig. 1, then it might be done this way

Is It "So Simple"... or "Not So Simple"?

Alternate solutions suggested for plant piping problem

By Con Fuzed

• *The author — an experienced piping engineer — has contributed the following comments to stimulate further interest in this piping problem. However, he writes under a nom de plume since he feels that there is no point in introducing his company affiliation in a matter of this kind.*

MARTIN MACVANE, gasket salesman and hero of Bill Dopp's articles in HPAC, helped his friend Herman Shultz, chief engineer for the "Southern Food Products Co." by giving him some advice in the article, It Looked So Simple, in the July HPAC. P. I. Ping came along in August with his comment, Not So Simple After All, and questioned Martin MacVane's advice. He offered some less simple solutions to Herman Shultz's plant piping problem.

In a Rut?

Let's review — in order — what's happened thus far. Herman followed the general contour of a previous boiler lead when designing the connection for a new boiler. He got into trouble. Martin suggested some modifications, cold spring, etc., but followed the same general pattern of a quarter bend for the boiler lead. Then Mr. Ping finds some valid objections to Mr. MacVane's solution. Perhaps further discussion is in process by Messrs. Dopp and Ping.

Con Fuzed's thinking is that Herman Shultz, Martin MacVane, and P. I. Ping got themselves into a rut and were determined to battle it out along the lines of a quarter bend. P. I. Ping and MacVane's sponsor pursue that poor quarter bend or 90 deg connection further. Are they confronting a tree and neglecting the forest beyond?

More Flexibility Desired

Con Fuzed believes that the original trouble should have suggested more of an alternative solution than MacVane concocted. The element of good design sense suggests that a lot more flexibility should be introduced into that boiler lead. Maybe it didn't have to be a straight 90 deg connection and that includes both the quarter pipe bend and the welding ell construction. Why not go to a different shape for this boiler lead? Does it have to be the same?

The first alternative might be a combination quarter and "U" bend as shown in Fig. 1. If limited headroom would preclude such a design, then a similar effect might be achieved as shown in Fig. 2. Con Fuzed, being somewhat of an old fogy, happens to like pipe bends but realizes that even a bit more flexibility might be had by using straight pipe and welding ells to follow either of the contours shown in Figs. 1 and 2.

Having injected this new weapon into the skirmish, Con Fuzed starts his strategic retreat.

Is Temporary Heating Covered?

INSURANCE POLICY fine print, as has oft been recommended, should be carefully perused. Better still, a lawyer's keen eye should be employed to hunt for weasel words designed to entrap someone. The following case turned out well for the heating, piping and air conditioning contractor — whether it was by good luck or otherwise does not appear. It is particularly interesting because it deals with temporary facilities.

George Dubble [all names are fictitious] owned The Insurance Building in a large city and conducted his general insurance business therein. Having his property's value as well as his own comfort in view, he engaged the D. Gree Contracting Co. to equip his building with a heating and air conditioning system. In his capacity as the agent for the Cosmo Casualty Co., he caused to be issued a contractor's liability policy insuring D. Gree's operations. He thus acted, so far as this case is concerned, in the dual role of building owner and liability insurance agent.

Completion of the contract was delayed pending the arrival of a necessary boiler. Meanwhile, Dubble had a tenant for the penthouse who was anxious to move in. The middle of January having arrived, the owner insisted that some method of temporary heating be made available. A gas fired unit was on hand, so D. Gree installed 25 ft of pipe along the floor from the heater to a gas supply main — where the connection was made.

This arrangement had nothing to do with D. Gree's main contract for installation of permanent facilities for heating and air conditioning, but it was done at Dubble's suggestion. It was taken for granted that the heater would be replaced later with the permanent installation. The following Monday the heater exploded — apparently due to a leaky connection in the gas line.

George Dubble thereupon sued the D. Gree Co. and obtained a judgment for $2000 damages. He also sued the Cosmo Casualty Co. to recover that sum upon the contractor's liability policy.

Affirming the district court's decision on this second action, the court of civil appeals held that the "explosion of the gas heating unit — temporarily installed by the insured contractor pending delayed completion of contract to equip the building with an air conditioning and heating system — arose out of operations necessary or incidental" to ownership, maintenance or use of the premises "within coverage of policy."

Contentions of opposing parties are enlightening to heating, piping and air conditioning contractors, most of whom are covered by liability insurance. The issue in this case was focussed on the "insuring provisions" embodied in the presumably standard wording of the policy. Building owner George Dubble contended, on one hand, that those insuring provisions established liability; the casualty company just as strongly argued to the contrary. Dubble claimed coverage under "Division 1, Premises, Operations", quoted below, for which insurance premium was paid. Contrawise, the defendant casualty company classified the explosion as within "Division 3, Products", *not* covered by the premium.

"Division 1" provided for coverage of operations during the policy period which were necessary or incidental to ownership, maintenance or use of the premises.

"Division 3" limited the coverage to handling or use of any goods or products made, handled or distributed by the insured (D. Gree in this case) and to an accident occurring *after* he had *relinquished* the premises to others. That division of the policy's wording also barred recovery under "Division 1" unless the accident should occur after the operations had been completed or abandoned "at the place of occurrence and away from such premises."

The higher court, in its decision, set forth the following: (a) the D. Gree Co.'s business was inclusive of heating and air conditioning operations; (b) the contract had not been completed at the time of the explosion; (c) the furnishing of temporary heat was but incidental to the principal contract, and not in itself a completed and independent transaction; (d) the contractor testified as to the unit's temporary character and the owner as to its contemplated removal.

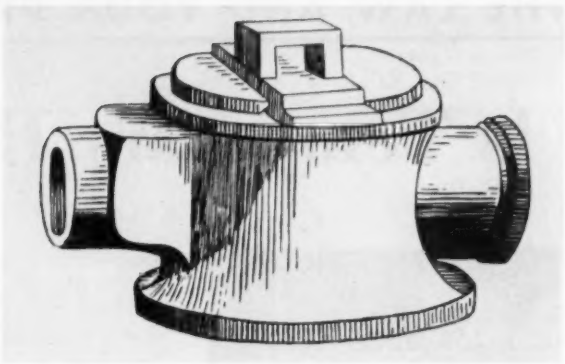
In view of these facts and evidence, the appeals court held the operation to be "well within the terms of 'Division 1' of the policy." A supporting case was aptly cited by the court in which a butane gas dealer was the insured and the policy provisions were identical. The opinion in that case construed such provisions as covering *all* operations — whether on the premises or elsewhere — which are *necessary or incidental* to the declared *use* of the premises.

In harmony with these and its own conclusions, the court of civil appeals, in our subject case, let the judgment against the casualty company stand.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

COPPER DRINKING "STRAW" discovered in the temple at Tell Asmer, used in 3000 B. C.



FOR INVENTION of the "plug cock," the Greeks must be given the credit

ANYTHING CAN HAPPEN

How Important Is Piping?

By Bill Dopp

• *Almost anything can happen when you're in the engineering, operating, contracting or sales ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss practical problems that need solving — and ways to solve them.*

Bill Dopp has had 40 years of experience dealing with piping, including a long stretch of service as a sales engineer. He is devoting some of his present leisure to drawing on his many piping experiences.

This month our old friend, Martin MacVane, was asked to make a talk before the Engineer's Club on the history of piping. . . .

"HELLO, MARTIN MACVANE. How are you? It's good to see you here. Do you know Jim Harrington?" Buck Hanson was beaming all over. Greeting Mac in the foyer of the Engineer's Club meeting place, he took him under his wing and saw to it that he met old friends and made him acquainted with new members. Through it all Mac had sort of a preoccupied look, until Andy Brown came along.

"Come on, Mac," said Andy, "It's time to get started. Are you ready?"

"Everything's under control," replied Mac, as they went into the hall and up on to the platform.

"Have you got your notes and everything you need?" Andy inquired. When Mac nodded, Andy picked up the gavel to bring the meeting to order. As the room became quiet, he stepped up to the lectern, looked the group over with a broad smile, and said: "Gentlemen, It's grand to see such a fine turnout tonight. I'm gratified. Because we are going to hear something that I think we all should know, we will dispense with our usual business meeting tonight." He smiled at the grins that this announcement provoked.

"We have with us tonight a man many of us are proud to call a friend. He has had a long and varied career as an engineer. Beginning his career on a tramp steamer, he was advanced to the post of chief of one of our largest power plants. He now occupies his time visiting us — and from time to time selling a few gaskets." A general laugh greeted this remark.

"And darn good gaskets they are, too," barked a voice from the audience.

Andy continued. "Our engineer friend has had a hobby for many years, something that I think all of us should have. He has studied the history of piping and valves until now he has quite an extensive library on the subject." Andy paused. "Gentlemen,—Mr. Martin MacVane, affectionately known to most of us as Mac." He turned to the expectant speaker and asked, "Mac, just how important is piping?"

Hearty applause greeted the speaker. Mac accepted the greeting with modest pleasure. Waiting until the room was quiet, he began:

Piping Indispensable

"My friends, Mr. Brown asks, 'How important is piping?'—It is so important that without it modern civilization could not exist. Piping is the arteries and the veins that carry the lifeblood of this civilization. It is the one form of transportation that man cannot do without, if he is to continue to live in social aggregations like our cities and towns. Piping is, unlike man, indispensable."

"Pipe lines are like people in many respects. Some are rough and rugged. Others, like our high pressure steam lines, are truly aristocratic, all dressed up as befits their place in life. They are frequently temperamental. They often hammer and

Photo on this page courtesy of Oriental Institute, University of Chicago.

kick and spit so that they require a lot of care. Some of them sing at their work or go on silently giving their service year after year without murmur or complaint. Their lives are so varied and the things they have to do are so numerous that I sometimes think that one has to be a psychologist to understand them. The history of piping also is completely tied up with the history of man. In fact, piping is one of the most important differences between modern man and his primitive ancestors. It is a fascinating story."

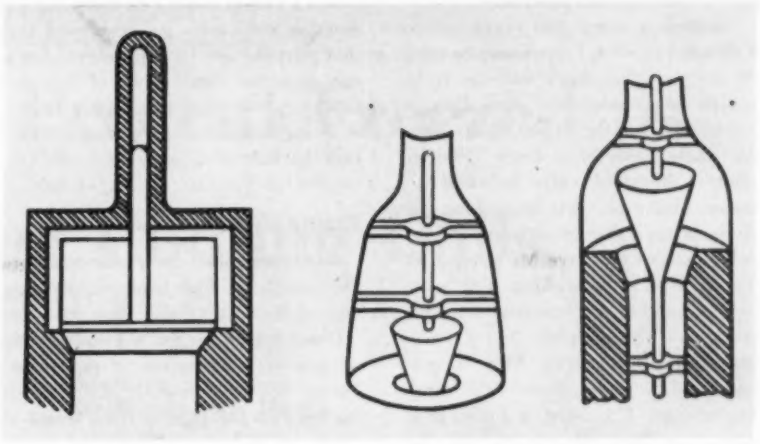
Piping is Transportation

Mac moved to the other side of the lectern. "Piping is transportation. It is a conveyor of fluids from one place to another. The discovery and development of every new kind of transportation has changed the social, economic and political life of man. Just as the airplane is completely changing our modern world, so in the distant past the discovery of pipes to convey fluids changed the lives of the people of those early days. The idea is commonly held that pipes were first used to convey water. However, all of the evidence points to their first use as a conveyor of sewage, for in the hot countries where civilization began, the disposal of sewage is a major problem."

Copper Tubing — 3000 B.C.

Stepping behind the lectern, he went on. "In the excavations at Tell Asmer, an Assyrian city of some importance, an astonishing discovery was a large earthen vessel containing a hoard of copper utensils. The item that is of greatest interest is a seamless tube made of almost pure copper. It must have been made by some kind of piercing process. It is about ¼ in. inside diameter and ⅛ in. thick, and is 28 in. long. One end of it is perforated with small holes to form a strainer. It is badly corroded but still in very good condition. The tube was undoubtedly used for drinking beer, which in those days was not strained of all of its ingredients before it was served. Here is one of the first evidences of metallic pipe. This piece of pipe was in use nearly 5000 years ago." Mac paused for a moment to let the thought sink in.

"Things like this seem fantastic when you think of how modern we imagine ourselves to be today. At about this same time, around 2700 B.C., an Egyptian workman was laying a different kind of copper pipe. Forming the copper, which had been discovered in the Arabian desert centuries before, into sheets about 40 in. long and 1/16 in. thick he rolled it over a wood mandrel about 2 in. in diameter using a clinched overlapping joint to make the seam. About 1300 ft of this pipe was laid in a limestone channel and cemented it in place with gypsum plaster. The joints were made by enlarging one end and slipping the next piece into it.



A "NEW" VALVE was developed by Leonardo da Vinci in 1514

First Valves Found

"This knowledge of using tubes for conveying fluids seems to have been pretty well spread over the ancient world. In the temple of Minos, the palace of the kings of Crete, were found baked clay pipes with flanges to hold them in place. It is here that we come across the first known valve. The word itself from the Latin valva, meaning door, gives us a clue to the kind of valve we would find here. It was probably a wooden slab, covered with leather, hung from the top on hinges. Placed in this way it was quite similar to the backflow valve used today.

Lead Pipe Discovered

"Our next knowledge of valves comes almost 2500 years later when the Greeks, in their city states, began to employ lead pipe for carrying water to the temple fountains. We do not know at what period lead pipe came into use, but there is little doubt that it was centuries before the Greeks began the construction of their beautiful cities. All evidence appears to point to the Greeks, however, as the inventors of the plug cock. This is the first type of metallic valve that has been discovered. Some of these specimens, almost exactly like our modern valves, date back to 450 B.C. In the ensuing centuries, for almost 2000 years, a period longer than the present Christian era, this type of valve served all of the needs of civilization, principally in the control of the flow of water.

Valves Improved

"Not until the great engineer and artist, Leonardo da Vinci, came along did anyone think of a new type. He had been commissioned to plan an irrigation system for the plains of Lombardy. He had to raise water several hundred feet and found that with the pumps available it could not be done. He would have to use a series of open pools and separate pumps to create a sort of stairway to lift the water. Genius that he was, he found a way out of his difficulty by taking the ancient plug cock and changing the shape of the body. Making a cylinder with a seat opening in the bottom, and putting two guide ribs into the stream, he used the plug with guide stems at top and bottom so the water coming from below would lift the plug. When the flow stopped, the plug would drop down and prevent the water from reversing the flow. One can hardly tell it from the vertical check valves sold today. I do not mean that his leaked like some of those that we get." A general laugh greeted this statement and everyone got a chance to shift his

feet and change his position.

"It took another 100 years before it dawned upon a Frenchman to turn the body of this check valve at right angles and substitute the Roman screw jack for the upper stem. Thus the angle valve was born. Shortly after it the globe valve followed. It seems incredible that such long periods of time should separate the development of new types of apparatus. Yet it was fully another 100 years before another French engineer substituted a sliding plate and gave us the first of our long line of gate valves. Of course, these were crude beginnings, but once a basic principle has been discovered, all that follows is simply a refinement of the original idea. While cast iron double disc gate valves were quite common in the early part of the 19th century the wedge gate was not invented until much later. In the early 1860's a man named Chapman got a patent on a cast iron wedge gate valve. This was a revolutionary idea but it still followed the principle of the original valve. It was a cast iron tee with slanting seats, a wedge shaped disc, a cover and a screw stem. Again, nearly 100 years pass before someone finds the substitute for the continued effort to blow the cover off a valve. From the Greek water cock to the modern 2500 psi pressure seal steel valve of today is a long jump — 2400 years."

Cast and Wrought Iron Pipe

Mac paused, shifted his position and again slightly raising his voice, said, "Cast iron pipe had been made in Germany as early as the 17th century. Its early history, however, is shrouded in mystery. It was generally used for conveying water. Wrought iron pipe was invented in response to a demand of an entirely different nature. Late in the 1700's, gas for illuminating purposes was developed in England. The problem was to convey it to the user. Gun barrels of wrought iron had been used in Europe for three centuries. They were made by bending a plate over a mandrel and welding the seam. Old gun barrels were screwed end to end by using a band to receive the two ends so that they could be used for gas pipe. Thus the wrought iron pipe industry was started to supply London streets with gas light. In 1812 Osborne invented the first method for making long iron tubes, and the principles he developed for this purpose are in use today. Let's not miss the significance of this development of tubular transportation; it is one of the most important factors in human history and the key to the civilization of our time."

Piping Uses Unlimited

Mac gave Mulhern a chance to get the cough he had been suppressing out of his system, and then went on. "Today we transport a great variety of materials by means of pipe lines. Steam up to pressures of 3200 psi so hot that the pipe is red. Water at 7000 psi, oil at 1500 psi and gasses at 2500 psi are common in our modern industrial plants. Chemicals of every description are transported by piping; food products literally from soup to nuts, paint, varnish, grain, salt, soap and no end of other things go through pipes made of nearly every metal known. Metallic pipe has been made as fine as a hair, while the pipe for some of our great reclamation projects is over thirty feet in diameter."

Mac was coming to the climax of his talk.

"Some of the greatest transportation systems in the world are made wholly of pipe. The mammoth pipe line systems that carry oil and gas all over our country for fantastic distances in many parts of the world rival anything else that man has ever done to transport goods or useful commodities from one place to another. Some of the great water systems of our western states crawl over mountain ranges and deserts to supply cities 20 times as large as the great aqueducts of antiquity served. Our cities are honeycombed from end to end by a maze of piping crossing and recrossing. Our factories, office buildings, even our homes are a network of piping. Hundreds of thousands of miles are found in even a moderate sized city. Such cities could not exist at all except for this universal vehicle for the transportation of vital necessities.

Without Piping — Collapse

"Every one of these countless pipe lines is an integral unit in the fabric of our industrial and social structure. It has a definite and complete duty to perform. Only good, efficient, safe, well designed piping is the proper medium to carry the lifeblood of industry; yes, the very lifeblood of society, to every nook and cranny of our vast and complicated civilization. Without piping, our whole structure would collapse like a house of cards." Mac lowered his voice almost to a whisper. Leaning forward he said very slowly and emphatically. "That's how important piping is. Without it, our world would perish."

There was a moment of silence. Then a round of applause broke out as Mac sat down.

READER ASKS —

What's Good Method of Piping, Controlling Three Boilers?

"Is the Hartford loop of any value except on a closed gravity wet return steam system? If so, where?

"What is a good method of piping up and controlling three heating boilers, which are to be used in series, as the load increases. The boilers are of equal capacity, oil fired, and the first one is always on for the requirements of service hot water. It is desired to start the second and third boilers in sequence as the heating load increases. They operate at 2 psig.

"The heating system uses an open gravity return, with a vented receiving tank and a condensate pump. A sketch or sketches showing boiler piping connections, methods of controlling the pump and make-up water and finally a system of automatic control to turn on the respective burners as the heating load increases would be appreciated." —H. E.

[You are invited to comment on these questions, giving actual examples if possible. Address the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2].

QUESTION OF THE MONTH

How We Prevent Freeze-Ups of Our Cooling Coils

By W. A. Stahl

Operating Manager
The Merchandise Mart

• *IF YOU DON'T HAVE the answer to a heating, piping or air conditioning problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange."*

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

• *HOW TO GUARD against freeze-ups of air conditioning cooling coils was the question asked by a building management firm and published in the November HPAC. The experience of a large air conditioned building is reported this month. Reports and comments on how other plants and buildings have solved this important problem (it cost $4500 in one instance to replace a coil damaged by freezing) will be welcomed for future publication.*

LIKE MANY other buildings, the Merchandise Mart, Chicago, has suffered from ruptured air conditioning cooling coils resulting from freeze-ups after draining, due to water pockets in sagged portions of the coil. The original method used to clear coils of water was to blow them out with high pressure air. This high pressure air tended to channel through the water pockets rather than to push the water out, and freezing of the remaining water occurred at this low point with consequent splitting of the coil piping. Fortunately, these breaks were not serious enough to require complete coil replacement and repairs were made to the damaged coils in place.

Anti-Freeze Solution Used

The next method used at the Mart was to blow out the coil with a large volume of low pressure air (40 psi) after which an anti-freeze solution was pumped through the coil and then drained out. Thus, any residue left in the lower portion of the tubes was a non-freeze solution. The chief disadvantage of this method is that it takes considerable time and it is necessary to drain the system early in the fall at the first sign of freezing weather. Usually after draining the system, there are many warm fall days when cooling is required. Then, the same problem in reverse is experienced in the spring when the system can not be refilled with water until the threat of freezing weather is over.

After a system is drained, considerable rusting takes place during the shutdown period. The result is that the rust scale after refilling causes additional trouble by clogging the coils.

Use of anti-freeze instead of water was not considered for several reasons. First, the extremely large quantity of the material required (26,000 gal) is expensive, and, second, the system is being extended from time to time, requiring draining for new cut-ins so that either the anti-freeze would be wasted or a large tank would have to be installed for storage to make it possible for the solution to be pumped back into the system.

Preheater Installed

The best solution from our standpoint was to keep the water in the system all year. In order to do this, a heat exchanger of sufficient capacity was installed to heat the water from 30 F to 50 F. One of the circulating pumps is kept operating whenever the weather approaches freezing. In addition, the preheater coil has a control which turns it on just as soon as the temperature goes below 35 F.

The greatest advantage in the use of this method is the availability of cooling during the entire winter season. It is not unusual during the winter months to have an unseasonable day with temperatures above 50 F with rain. In this case, we find it necessary to air condition some rooms in order to maintain comfort.

With this method, corrosion has been reduced to a minimum and the two large scale traps which have been installed (24 in. x 8 in.) on the two chilled water mains gather very little scale. The expense when draining for cut-ins and extensions of the systems for sections of the building not now air conditioned is comparatively small (we do have to apply new chemical treatment for the water on refilling at a cost of $125 per filling).

What To Watch For

We have noted other items which should be given close attention in connection with the chilled water system.

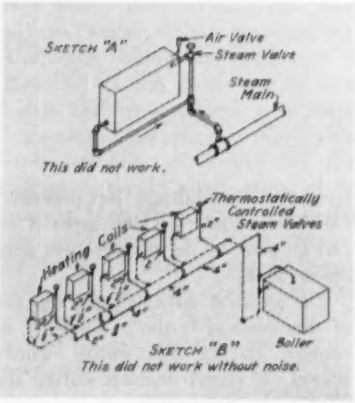
1) The return air system must be installed properly so as to prevent possible stratification.

2) If return piping from coils runs up to the return riser it is generally unsatisfactory as there is a greater tendency to trap scale and dirt in the coil.

3) Coils must be checked periodically to prevent accumulation of sediment with a slowing down of circulation — all of which could result in freeze-ups in case of failure of one of the controls.

SAM LEWIS' PAGE

Correcting a Poor Steamfitting Job



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. He suggests this month how to correct a heating and cooling installation which has been giving trouble

AN INTERESTING piece of bad steamfitting involves a low pressure steam boiler and four self contained cooling and heating unit air-circulating machines. These machines each have an electric refrigerating compressor and an air cooling coil with a circulating fan.

No Heat, Noisy

The owner wished not only to cool the rooms in warm weather, but also to heat them in cold weather, and to that end he had provided a finned heating coil within each casing. There is an electrically operated steam valve on the supply branch to each of these units.

The man who arranged this steam connection, however, must have thought that steam and water, contained within the little tubes, would behave like a liquid and gas refrigerant. Unfortunately, this thought was an illusion. The piping was first installed as is shown in sketch "A", in which the condensate was expected to flow back, counter-current against the incoming steam. The coils in the units failed to become warm, and in addition, noisy turmoil resulted.

Separate Return

Someone suggested that a separate downgoing return pipe and a separate return main for each heating coil must be provided. In accordance with this advice, an additional return main, as shown in sketch "B," was added. The size or duty of each of the heating coils in the units is not known, but it is almost certain that the return pipes are too small. Also, the differences in elevation between the boiler and the heating coils are not known.

Returns Too Small

If the service expected from the coils is commensurate with the steam pipe sizes, then the return pipes are only about half large enough for service in a gravity flow dry return system. Any steam supply valve in a heating plant — when closed — prevents the entry of steam. The coil served by that valve soon cools down after the steam is shut off. After steam condenses in a closed vessel, there is always a tendency toward a partial vacuum — any coffee percolator illustrates this.

In this case, the partial vacuum within the coils holds back the condensate from leaving through the open return pipe. The air valve probably prevents air from entering the coil to break the partial vacuum. After each opening of the steam supply valve in this installation, there is a serious noise in the piping.

Of course, there will be a noise when steam strikes the relatively cool water in the poorly drained heating coil. The chances are fair that if there were no steam supply valves, the condensate might drain without noise, though possibly only the coil nearest the boiler would drain properly.

Two Methods Suggested

The safest permanent cure for this system will be to replace the too small dry return system with a larger return main that is below the water level of the boiler and with an electric valve not only in the supply branch but also in the return branch. It is not known whether it is possible to place a wet return in this job. A second scheme would be to install a ½ in. thermostatic trap in the outlet from each coil, joining a new return main that would be at least 1 in. where it is shown as ½ in.; 1 ¼ in. where it is shown as ¾ in. and not less than 1 ½ in. all the balance of the way to the boiler. There should be an automatic air vent in the return main about 2 ft above the boiler water level, and the condensate must enter the boiler at the bottom of the boiler rather than near the water level, as shown in sketch "B".

Air Conditions for Film Storage Vault

A NEW FILM storage vault was put into service at the Caterpillar Tractor Co., Peoria, Ill., a few weeks ago.

For acetate film, the room is being maintained at 70 F dry bulb and 50 percent relative humidity. For the storage of nitrate film, the space is held at 50 F and 50 percent. The conditions were determined as the consensus of various authorities on film storage.

Since the nitrate film is an old type which is being replaced by acetate, the nitrate storage room is cooled from 70 F to 50 F by means of a product cooler. When there is no longer any of the nitrate film to be stored, the product cooler and its compressor will be removed for use elsewhere, and the room will assume the 70 F, 50 percent condition.

DATA SHEET

Weather Bureau Issues New Degree Day Normals

THESE NEW NORMAL degree day figures are based on U. S. Weather Bureau records for the 30 year period 1921 to 1950, inclusive.

They are computed on the standard 65 F base.

Further information about them was given on page 133 of the November HPAC, where the figures for Alabama — Illinois, inclusive, were published. More of the figures will appear next month.

NEW NORMAL DEGREE DAY figures, monthly and seasonal
AP indicates airport station, CO city office station

Station	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
INDIANA													
Evansville AP	939	770	589	251	90	6	0	0	59	215	570	871	4360
Fort Wayne AP	1200	1036	874	516	226	55	0	17	107	377	759	1122	6287
Indianapolis AP	1122	938	772	432	176	30	0	0	79	306	705	1051	5611
Indianapolis CO	1051	893	725	375	140	16	0	0	59	247	642	986	5134
South Bend AP	1252	1081	908	531	248	62	5	13	101	381	789	1155	6524
Terre Haute AP	1107	913	725	371	145	24	0	5	77	295	681	1023	5366
IOWA													
Burlington AP	1271	1036	822	425	179	54	0	0	85	336	765	1150	6101
Charles City CO	1494	1240	1001	537	256	70	17	30	151	444	912	1352	7504
Davenport CO	1262	1044	834	432	175	35	0	7	79	320	756	1147	6091
Des Moines AP	1330	1092	868	438	201	45	5	12	99	355	798	1203	6446
Des Moines CO	1308	1072	849	425	183	41	0	6	89	346	777	1178	6274
Dubuque AP	1414	1187	983	543	267	76	8	28	149	444	882	1290	7271
Sioux City AP	1423	1170	930	474	228	54	8	17	128	405	885	1290	7012
KANSAS													
Concordia CO	1144	899	725	341	146	20	0	0	55	227	687	1029	5323
Dodge City AP	1076	840	694	347	135	15	0	0	40	262	669	980	5058
Goodland AP	1215	974	884	534	241	58	0	0	95	415	825	1128	6367
Topeka AP	1125	885	694	326	137	15	0	8	59	271	672	1017	5209
Topeka CO	1088	851	669	295	112	13	0	0	42	242	630	977	4919
Wichita AP	1023	778	619	280	101	7	0	0	32	219	597	915	4571
KENTUCKY													
Bowling Green AP	890	739	601	286	98	5	0	0	47	215	558	840	4279
Lexington AP	1008	854	710	368	140	15	0	0	56	259	636	933	4979
Louisville AP	933	778	611	285	94	5	0	0	51	232	579	871	4439
Louisville CO	911	762	605	270	86	0	0	0	41	206	549	849	4279
LOUISIANA													
Baton Rouge AP	424	295	215	48	0	0	0	0	0	27	215	375	1595
Burrwood	303	226	169	29	0	0	0	0	0	0	81	225	1033
Lake Charles AP	416	284	210	40	0	0	0	0	0	22	218	353	1543
New Orleans AP	364	248	190	31	0	0	0	0	0	7	169	308	1317
New Orleans CO	341	223	163	19	0	0	0	0	0	5	141	283	1175
Shreveport AP	550	386	272	61	0	0	0	0	0	53	305	490	2117
MAINE													
Caribou AP	1745	1546	1342	909	512	201	85	155	354	710	1074	1562	10173
Eastport CO	1333	1201	1063	774	524	288	141	136	261	521	798	1206	8246
Portland AP	1373	1218	1039	693	394	117	15	56	199	515	825	1237	7681
MARYLAND													
Baltimore AP	942	820	651	360	97	0	0	0	43	256	558	884	4611
Baltimore CO	880	776	611	326	73	0	0	0	29	207	489	812	4203
Frederick AP	1001	865	673	368	106	0	0	0	47	276	588	930	4854
MASSACHUSETTS													
Boston AP	1113	1002	849	534	236	42	0	7	77	315	618	998	5791
Nantucket AP	1020	949	880	642	394	139	22	54	111	372	615	924	6102
Pittsfield AP	1358	1212	1060	690	336	105	25	65	213	543	843	1246	7694

NEW NORMAL DEGREE DAY figures, monthly and seasonal

AP indicates airport station, CO city office station

Station	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
MICHIGAN													
Alpena CO	1358	1265	1136	762	437	153	50	83	215	530	864	1218	8073
Detroit Willow Run AP	1251	1089	915	552	241	33	0	10	96	393	759	1125	6469
Detroit City AP	1203	1072	927	558	251	60	0	8	96	381	747	1101	6404
Escanaba CO	1473	1327	1203	804	471	166	62	95	247	555	933	1521	8657
Grand Rapids AP	1287	1154	1008	606	301	79	14	29	144	462	822	1169	7075
Grand Rapids CO	1215	1086	939	546	248	58	0	20	105	394	756	1107	6474
Lansing AP	1277	1142	986	591	287	70	13	33	140	455	813	1175	6982
Marquette CO	1435	1291	1181	789	477	189	69	87	236	543	933	1299	8529
Muskegon AP	1243	1134	1011	642	350	116	26	48	152	462	795	1110	7089
Sault Ste. Marie AP	1587	1442	1302	846	499	224	109	126	298	639	1005	1398	9475
MINNESOTA													
Duluth AP	1773	1529	1339	846	474	178	56	91	298	651	1140	1606	9981
Duluth CO	1696	1448	1252	801	487	200	66	91	277	614	1092	1550	9574
International Falls AP	1922	1618	1395	834	437	171	70	118	356	716	1230	1733	10600
Minneapolis AP	1562	1310	1057	570	259	80	8	17	157	459	960	1414	7853
Rochester AP	1572	1316	1073	600	298	92	24	38	182	499	975	1426	8095
St. Cloud AP	1690	1459	1181	663	331	106	32	53	225	570	1068	1535	8893
St. Paul AP	1553	1305	1051	564	256	77	12	21	154	459	951	1401	7804
MISSISSIPPI													
Jackson AP	535	405	299	81	0	0	0	0	0	69	310	503	2202
Meridian AP	561	413	309	85	9	0	0	0	0	90	338	528	2333
Vicksburg CO	507	374	273	71	0	0	0	0	0	51	268	456	2000
MISSOURI													
Columbia AP	1091	876	698	326	135	14	0	6	62	262	654	989	5113
Kansas City AP	1085	851	666	292	111	8	0	0	44	240	621	970	4888
St. Joseph AP	1175	930	716	326	127	14	0	5	49	265	681	1048	5336
St. Louis AP	1017	820	648	297	101	11	0	0	45	233	600	927	4699
St. Louis CO	983	792	620	270	94	7	0	0	38	202	570	893	4469
Springfield AP	1001	790	632	295	118	16	0	8	61	249	615	908	4693
MONTANA													
Billings AP	1305	1089	958	564	304	119	8	20	194	497	876	1172	7106
Butte AP	1575	1294	1172	804	561	325	115	174	450	744	1104	1442	9760
Glasgow CO	1683	1408	1119	597	312	113	14	30	244	574	1086	1510	8690
Great Falls AP	1311	1131	1008	621	359	166	24	50	273	524	894	1194	7555
Havre CO	1513	1291	1076	597	313	125	20	38	270	564	1023	1383	8213
Helena AP	1469	1165	1017	654	399	197	36	66	320	617	999	1311	8250
Helena CO	1438	1114	992	660	427	225	51	78	359	598	969	1215	8126
Kalispell AP	1386	1120	970	639	391	215	47	83	326	639	990	1249	8055
Miles City AP	1516	1229	1048	570	285	106	6	11	187	525	966	1373	7822
Missoula AP	1414	1100	939	609	365	176	22	57	292	623	993	1283	7873
NEBRASKA													
Grand Island AP	1302	1044	849	423	195	39	0	6	84	369	822	1178	6311
Lincoln AP	1271	1030	822	401	190	38	0	12	82	340	774	1144	6104
Lincoln CO	1240	1000	794	377	172	32	0	7	79	310	741	1113	5865
Norfolk AP	1417	1159	933	501	251	60	0	17	122	422	903	1280	7065
North Platte AP	1271	1016	887	489	243	59	7	11	120	425	846	1172	6546
Omaha AP	1302	1058	831	389	175	32	0	5	88	331	783	1166	6160
Scottsbluff AP	1287	1030	933	567	305	81	0	0	137	456	867	1178	6841
Valentine CO	1361	1100	970	543	288	83	11	10	145	461	891	1212	7075
NEVADA													
Elko AP	1336	1025	896	612	378	183	6	28	229	546	915	1181	7335
Ely AP	1302	1033	921	639	418	200	22	44	228	561	894	1181	7443
Las Vegas AP	653	423	288	92	0	0	0	0	0	61	344	564	2425
Reno AP	1048	804	756	519	318	165	27	61	165	443	744	986	6036
Tonopah	1082	860	763	504	272	91	0	5	96	422	723	995	5813
Winnemucca AP	1153	854	794	546	299	111	0	17	180	508	822	1085	6369
NEW HAMPSHIRE													
Concord AP	1392	1226	1029	660	316	82	11	57	192	527	849	1271	7612
NEW JERSEY													
Atlantic City CO	903	829	729	468	189	24	0	0	29	230	507	831	4741
Newark AP	1039	932	760	450	148	11	0	0	47	301	603	961	5252
Trenton CO	1004	904	735	429	133	11	0	0	55	285	582	930	5068
NEW MEXICO													
Albuquerque AP	970	714	589	289	70	0	0	0	10	218	630	899	4389
Clayton AP	995	795	729	420	184	24	0	0	68	318	678	927	5138
Raton AP	1203	924	834	543	292	87	17	36	148	431	798	1104	6417
Roswell AP	787	566	443	185	28	0	0	0	8	156	501	750	3424

This tabulation will be continued next month.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

Solar Energy Availability for Heating in the United States †

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This paper is the result of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with the Department of Mechanical Engineering of the University of Minnesota

SUMMARY — This first of three articles deals with the availability of solar energy in the United States. The depletion of the country's fuel reserves and necessity for direct utilization of solar energy in the future is discussed. Results of extensive calculations showing distribution of solar radiation available in the United States on variously oriented surfaces are presented for cases (1) outside the atmosphere, (2) at the earth's surface during cloudless days and (3) at the earth's surface during all days.

Included are discussions of the earth's position relative to the sun, the solar constant, and depletion of radiation by the atmosphere. The superiority of a south-facing surface for interception of winter sunshine is shown. Maps show estimated average daily radiation incident upon a south-facing vertical surface for December and January. Results of analyses of U. S. Weather Bureau records for Blue Hill, Mass.; Madison, Wis.; Lincoln, Neb.; Nashville, Tenn. and New Orleans, La. are discussed.

IN THIS SERIES of papers on solar energy the first deals with potential utilization of solar energy as a total or partial heat source for the heat pump. The second is devoted to systems and components, and the third covers design and economics.

For the past five hundred million years petroleum deposits have been accumulating on the earth and for two and one-half hundred million years coal has been accumulating. Man, a comparative latecomer, learned to harness this energy only during recent years. Over 85 percent of all the fossil fuels used have been consumed since 1900. Probably the best estimates[1] of the life expectancy of fossil fuel reserves in the United States vary from a minimum of about 75 years to a maximum of 250 years, an average of about 160 years. Although such figures are difficult to determine with accuracy and involve changing rates of fuel production and changing rates of demand, the order of magnitude is correct and the fact remains that sources of stored fuel are rapidly running out. Within another century natural petroleum deposits will be rare, 80 percent of liquid fuel will probably come from coal, and natural gas will be scarce. In the foreseeable future new sources of energy must be tapped or present increasing standards of living, so

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[1]Exponent numerals refer to References.

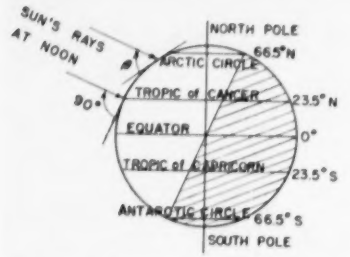

Fig. 1—Position of earth relative to noon sun's rays on June 21

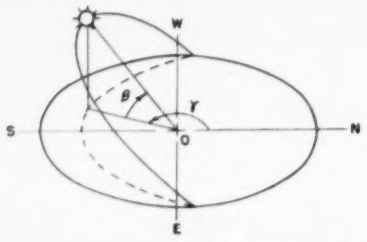

Fig. 2—Diurnal path of sun illustrating solar altitude and azimuth angles

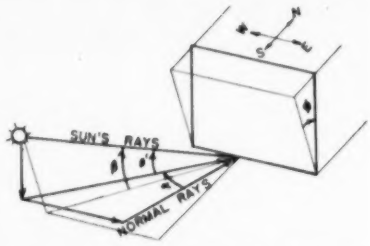

Fig. 3—Relation of sun's rays to south-facing surface

dependent upon energy and power, will degenerate.

With negligible exceptions, all energy sources originate from the sun. Those such as hydroelectric power and the burning of vegetation and trees for fuel are current and renewable. The greatest sources of energy for power or heating, however, are the fossil fuels, such as, petroleum, natural gas, coal, tar sands, and similar deposits. In effect, then, the sun is the only real source of energy, and the potentialities of its direct utilization dwarf all of the major energy sources available. If all of the earth's estimated coal, petroleum, lignite, natural gas and other fossil deposits ever likely to be produced plus the fuel potential of all timber were stockpiled, the total energy represented would be equivalent only to a three-day supply of the solar energy intercepted by the earth from the sun.

Unfortunately, solar conversion systems for the translation of the sun's energy to useful electrical or mechanical energy are still inefficient. The efficiency of utilization of solar energy in the process of photosynthesis is in the order of 0.1 to 0.5 percent. The overall efficiency of photoelectric cells, capable of direct conversion of light to electrical energy, approximates 1 percent. Thermoelectric conversion of heat to electricity by means of thermocouples has attained an encouraging 7 percent efficiency. Swiss solar water heating systems for the collection of solar energy and its storage in the form of useful heat are said to have attained peak collection efficiencies of 36 percent and average monthly efficiencies of 10 percent in March and August. The Dover, Mass. solar house designed for solar collection and heating has successfully attained collection efficiencies as high as 63 percent by contributions directly through south fenestration and by south-wall solar collectors. The direct collection of solar energy as heat is, at this time, much more efficient than its conversion to other forms of energy, and the first sizeable engineering contributions are likely to lie in this direction. Fortunately, tremendous contributions are potentially achievable, since nearly a third of the total energy requirements of the United States are consumed in the heating of homes and buildings. This figure is increased to almost 50 percent when expanded to include the world.

The temperature of the solar energy collected must be high if the energy is to be converted to power, but can be comparatively low if it is to be used for space heating. Further, the efficiency of collection and storage is low at high temperature but, in general, increases as the temperature decreases. For direct space heating, the collection temperature must be higher than the temperature of the rooms which it heats, but if aided by a booster or heat pump it can be lower than the temperature of the heated space. No advantage accrues, however, unless the temperature of the solar energy collected is higher than that of normally available heat sources for heat pumps.

Potentially, then, solar energy may be used for the direct production of power, it may be used directly for space heating, or it may be used indirectly as a partial or total heat source for heat pump systems. The conversion of solar energy to electrical or mechanical power is both possible and eventually probable. C. G. Abbot[2] of the Smithsonian Institution, associated for many years with solar energy utilization studies, believes 15 percent of intercepted solar energy may be usable for power. He predicts that Mexico, because of geographical position, could supply 10 trillion horsepower hours per year or the equivalent of all the power annually consumed in the United States. H. C. Hottel of Massachusetts Institute of Technology believes solar power systems located in the Southwest could produce 50 hp per acre or about 14 trillion horsepower hours per year with energy collected over an area of about 40 percent of the state of New Mexico.

The purpose of this paper is to discuss the availability of solar radiation in the United States. The maximum radiation is available outside the atmosphere. As radiation passes through the atmosphere, it is split into three parts: (1) one part is turned aside from the direct beam and scattered in practically all directions; (2) another part is absorbed and changed into heat energy; and (3) the remainder is transmitted to the earth's surface unchanged in wavelength. During cloudless days 50 percent or more of the radiation available outside the atmosphere may be depleted, and during extremely cloudy days practically all may be depleted. Rational theoretical methods are known for calculating the irradiation of a surface outside the atmosphere and on the earth during

cloudless days. However, because of the complicating effects of clouds, no such theoretical procedure is known for calculating the average solar energy available at the earth's surface during all days, and recourse must be made to experimental data.

Direct Solar Radiation Available Outside the Atmosphere

Position of Earth Relative to Sun. The location of any point on the earth relative to the sun is continually changing due to the two principal motions of the earth: (1) rotation about its axis, and (2) revolution about the sun. The axis of rotation of the earth is tilted 23.5 deg with respect to the plane of its orbit about the sun. Fig. 1 shows the position of the earth relative to the noon rays of the sun on June 21 (the summer solstice). At this time the noon rays are normal to the earth's surface at the Tropic of Cancer. Regions south of the Antarctic Circle are enshrouded in darkness 24 hr per day, and there is continuous daylight north of the Artic Circle. The reverse is true at the time of the winter solstice (December 21) when the noon sun's rays are normal to the Tropic of Capricorn. At the time of the equinoxes (March 21 and September 21) the noon sun's rays are normal to the equator.

To an observer on the earth, the earth is fixed and the sun moves across the sky following the path of a circular arc from horizon to horizon. Fig. 2 shows such a diurnal path and describes two important angles involved in solar radiation calculations. These angles are the solar altitude and solar azimuth. The solar altitude β is defined as the angle in a vertical plane between the sun's rays and the horizontal. The solar azimuth γ is defined as the angle measured in a horizontal plane from north to the horizontal projection of the sun's rays. These angles vary continuously from sunrise to sunset but are symmetrical with respect to the north-south line.

The position of the sun relative to the earth at any time of day may be established if its declination, altitude and azimuth angles are known. The declination of the sun which is the angular distance of the sun north or south of the celestial equator is given in the Nautical Almanac.[3] The sun's altitude and azimuth are given in U.S. Hydrographic Office Tables 214.[4] In order to use the tables, the latitude, local hour angle, and declination must be known. The local hour angle is expressed in degrees (0 deg for 12 noon, 15 deg for 11 a.m. and 1 p.m., 30 deg for 10 a.m. and 2 p.m., etc.).

Table 1—Ratio of Radiation Intensity at Normal Incidence Outside Earth's Atmosphere to Solar Constant

Month	Day of Month 1	8	15	22
January	1.0335	1.0325	1.0315	1.0300
February	1.0288	1.0263	1.0235	1.0207
March	1.0173	1.0140	1.0103	1.0057
April	1.0009	0.9963	0.9913	0.9875
May	0.9841	0.9792	0.9757	0.9727
June	0.9714	0.9692	0.9680	0.9670
July	0.9666	0.9670	0.9680	0.9692
August	0.9709	0.9727	0.9757	0.9785
September	0.9828	0.9862	0.9898	0.9945
October	0.9995	1.0042	1.0087	1.0133
November	1.0164	1.0207	1.0238	1.0267
December	1.0288	1.0305	1.0318	1.0327

The Solar Constant. The intensity of solar radiation at normal incidence, at the outer limit of the atmosphere, and at the mean solar distance is known as the *solar constant*. During the past hundred years numerous determinations have been made of its value. The most accurate of these were made since 1905 by Abbot[5] and Fowle. At the present time the most accurate determinations and corrections[6] fix the solar constant as 1.896 g-cal per (sq cm) (min) or 419.40 Btu per (hr) (sq ft). The earth's orbit is slightly elliptical with the sun located off-center of the ellipse, resulting in the earth being about 3½ percent closer to the sun on January 1 than on July 1. As a result, there is about 7 percent greater radiation outside the atmosphere on January 1 than on July 1 which is apparently a contributing factor to the more severe winters of the southern hemisphere. Table 1, based upon the data of Fowle,[7] presents factors by which the solar constant should be multiplied to give normal incidence radiation outside the atmosphere for various days of the year.

Radiation Intensity Outside the Atmosphere Incident upon Various Surfaces. The component of the sun's rays normal to a horizontal surface is at any time of day (see Fig. 2):

$$I_H = I_n \sin \beta \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where

I_H = radiation incident upon a horizontal surface outside the atmosphere, Btu per (hour) (square foot).
I_n = radiation intensity at normal incidence outside the atmosphere, Btu per (hour) (square foot).
β = solar altitude angle.

The component of the sun's rays normal to a south-facing tilted surface is at any time of day (see Fig. 3):

$$I_{ST} = I_N \cos \beta' \cos \alpha \quad \ldots\ldots\ldots (2)$$

where new quantities are defined as

I_{ST} = radiation incident upon a south-facing tilted surface outside the atmosphere, Btu per (hour) (square foot).
ϕ = angular tilt from vertical position.
β' = $\beta - \phi$.
α = wall-solar azimuth angle = 180 deg $-\gamma$.
γ = solar azimuth angle

For the case of a south-facing vertical surface, $\phi = 0$, and the incident radiation I_s is given by

$$I_s = I_n \cos \beta \cos \alpha \quad \ldots\ldots\ldots\ldots (3)$$

Daily Total Radiation Outside the Atmosphere Incident upon Various Surfaces. Hourly rates of radiation throughout a day may be calculated by Equations 1, 2, and 3.

Table 2—Distribution of Solar Radiation, Btu per (hour) (square foot), Incident upon Horizontal and South-facing Vertical Surfaces Outside the Atmosphere on January 15 and July 15 at 42 deg North Latitude

Sun Time	January 15[a]				July 15[b]			
	Altitude β Deg-Min	Wall Solar Azimuth α Deg-Min	$I_H = I_n \sin \beta$	$I_S = I_n \cos \alpha \cos \beta$	Altitude β Deg-Min	Wall Solar Azimuth α Deg-Min	$I_H = I_n \sin \beta$	$I_S = I_n \cos \alpha \cos \beta$
5:00 a.m.	—	—	—	—	—	—	—	—
6:00	—	—	—	—	14 15	—	100	—
7:00	—	—	—	—	25 9	—	172	—
8:00	6 0	54 18	49	251	36 16	87 20	239	13
9:00	14 22	42 54	107	307	47 17	75 48	297	67
10:00	20 59	30 0	155	350	57 37	60 18	341	108
11:00	23 18	15 30	185	377	66 0	36 18	369	133
12:00	26 49	0 0	195	386	69 35	0 0	378	142
1:00 p.m.	25 18	15 30	185	377	66 0	36 18	369	133
2:00	20 59	30 0	155	350	57 37	60 18	341	108
3:00	14 22	42 54	107	307	47 17	75 48	297	67
4:00	6 0	54 18	49	251	36 16	87 20	239	13
5:00	—	—	—	—	25 9	—	172	—
6:00	—	—	—	—	14 15	—	100	—
7:00	—	—	—	—	—	—	—	—

[a] I_n = 433 Btu per (hr) (sq ft). [b] I_n = 406 Btu per (hr) (sq ft).

Sample results for horizontal and south-facing vertical surfaces for January 15 and July 15 at 42 deg north latitude are shown in Table 2. Once hourly rates are known, the total radiation incident upon the surface during the day may be found by summing up the hourly rates using Simpson's rule. Such calculations were carried out at weekly intervals throughout the year for 30, 36, 42, and 48 deg north latitude for a horizontal surface, a south-facing vertical surface, and a south-facing surface tilted such that the surface is normal to the sun's rays on January 15. This results in a tilt angle from the horizontal approximately equal to the latitude plus 21 deg.

The curves for daily total solar radiation incident upon horizontal and south-facing vertical surfaces outside the atmosphere for the various latitudes are shown in Fig. 4. In Fig. 5, curves of the ratio of the radiation incident upon a south-facing tilted surface (tilt angle from horizontal equal to latitude plus 21 deg) to that incident upon a south-facing vertical surface are shown.

Fig. 4 reveals that a horizontal surface intercepts a minimum of solar energy in winter and a maximum in summer, and that the reverse is true for a south-facing vertical surface. Fig. 5 indicates that little advantage results in northern latitudes by tilting a south-facing surface.

Since the curves of Figs. 4 and 5 are limited to solar energy reception outside the atmosphere, practical interpretation of the results in terms of reception of solar radiation at the earth's surface is also limited. However, the superiority of a south-facing vertical surface over a horizontal surface in the winter interception of solar energy is evident. In addition, south-facing vertical surfaces are more desirable in summer, since far less solar energy is incident upon them than upon horizontal surfaces at this time of year. The value of a south-facing tilted solar collector in relation to a south-facing vertical collector is questionable. There may be some justification for its use in southern latitudes, but in the more northerly latitudes, little additional solar radiation is incident in winter and a considerably greater amount is incident in summer when it is undesirable.

Solar and Sky Radiation Available at Earth's Surface During Cloudless Days

Depletion of Solar Radiation by the Atmosphere. The rate at which direct solar radiation is received by a particularly oriented surface on the earth during cloudless days depends upon (1) radiation intensity at normal incidence outside the atmosphere, (2) solar altitude and azimuth angles as determined by latitude, time of day and time of year, and (3) depletion of radiation by the atmosphere.

Numerous investigators have studied the problem of atmospheric depletion. They have found that scattering of solar radiation is caused by molecules of dry air and water vapor and by dust particles. The principal constituents of the atmosphere which absorb solar radiation are ozone and water vapor, but this absorption is selective, *i.e.*, it depends upon the radiation wavelength. This is also true for scattering. Thus, the spectral distribution of radiation, both outside the atmosphere and at the earth's surface, must be considered.

Much has been written on the theoretical and experimental aspects of atmospheric depletion, and perhaps one of the best papers is that of Parry Moon.[8] Moon has calculated spectral irradiation curves for a surface perpendicular to the sun's rays at the earth's surface during cloudless days. The ASHVE has taken these results as a standard for clear atmospheres and for typical summer conditions.

F. W. Hutchinson and W. P. Chapman[9] have applied Moon's

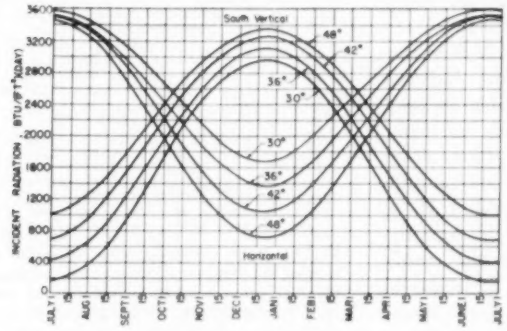

Fig. 4—Daily total solar radiation outside the atmosphere incident upon a horizontal surface and upon a south-facing vertical surface at various north latitudes

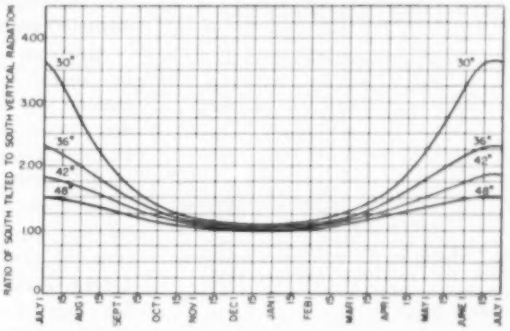
30°
30°
36°
42°
48°
RATIO OF SOUTH TILTED TO SOUTH VERTICAL RADIATION
JULY 15 AUG 15 SEPT 15 OCT 15 NOV 15 DEC 15 JAN 15 FEB 15 MAR 15 APR 15 MAY 15 JUNE 15 JULY

Fig. 5—Ratio of daily total solar radiation outside the atmosphere incident upon a south-facing surface tilted from the horizontal at an angle equal to the latitude plus 21 deg to that incident upon a south-facing vertical surface at various north latitudes

theory to wintertime conditions. They assumed conditions of 760 mm of mercury barometric pressure, water vapor content corresponding to 33 F dew-point temperature, 300 dust particles per cc, and 2.8 mm of ozone. The results of their calculations are shown in Fig. 6 where direct solar radiation at normal incidence is presented as a function of solar altitude angle. This curve is for the month of January only. The extension to other winter months is made by multiplying the January values by 430/435 for December and February, 425/435 for November and March, and 420/435 for October and April. These corrections allow for the varying distance between the earth and the sun. Hutchinson and Chapman recommend the use of Fig. 6 for practical engineering applications in most parts of the United States. It should be borne in mind, however, that this curve was constructed for a relatively dust-free atmosphere and for sea level, and thus does not apply to industrial areas or mountainous locations.

Sky Radiation during Cloudless Days in Winter. The direct solar radiation incident upon a particularly oriented surface during cloudless days in winter may be estimated by Fig. 6 with modification for the angular effect of the sun's rays. However, this figure does not include sky radiation which results from the absorption by the atmosphere of a portion of the direct solar radiation and the consequent re-radiation of a part of this to the earth. Whereas direct solar radiation is specular, or beamed, sky radiation is of diffuse nature and is generally of much longer wavelength than direct solar radiation.

The data available in the literature on sky radiation are very meager and, to some extent, inconsistent. This is particularly true of wintertime sky radiation. The ASHVE Research Laboratory at Cleveland has made observations of sky radiation received by variously oriented surfaces during summertime cloudless days.[10] A limited amount of data on sky radiation in summer and winter during cloudless days, based on measurements of the U.S. Weather Bureau at Washington, D. C. has been presented by I. F. Hand.[11] Hand's data, however, are for a horizontal surface only. In Fig. 7 the ratio of direct solar radiation to diffuse sky radiation during typical winter cloudless days is presented as a function of the solar altitude angle. Fig. 7 was constructed from Hand's data.

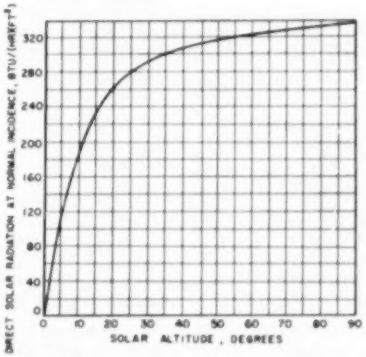
DIRECT SOLAR RADIATION AT NORMAL INCIDENCE, BTU/(HR)(FT²)
0 40 80 120 160 200 240 280 320
0 10 20 30 40 50 60 70 80 90
SOLAR ALTITUDE, DEGREES

Fig. 6—Direct solar radiation incident upon a surface perpendicular to sun's rays at sea level on the earth during cloudless days in January

Practically no data were found in the literature for sky radiation received by a south-facing vertical surface during cloudless days in winter. However, to estimate this quantity, Fig. 8 was constructed, using Fig. 7 together with the ratio of sky radiation received by a south-facing vertical surface to sky radiation received by a horizontal surface calculated from the summer data given in THE GUIDE. This ratio should be essentially the same for summer and winter. In Fig. 8 the ratio of direct solar radiation at normal incidence to diffuse sky radiation incident upon a south-facing vertical surface is presented as a function of the solar altitude angle.

Daily Total Solar and Sky Radiation Available at the Earth's Surface During Cloudless Days at 42 Deg North Latitude for October 1 to May 1. The calculation of hourly rates of solar and sky radiation incident upon variously oriented surfaces on the earth during cloudless days may be carried out with use of Figs. 6, 7, and 8. The results of such calculations for a horizontal surface and a south-facing vertical surface at 42 deg north latitude are shown in Table 3.

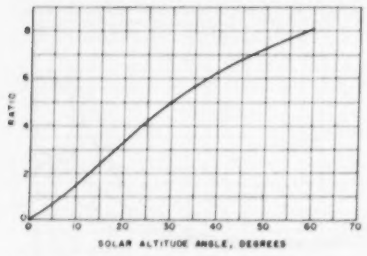

Fig. 7—Ratio of direct solar radiation to diffuse sky radiation incident upon a horizontal surface during typical winter cloudless days

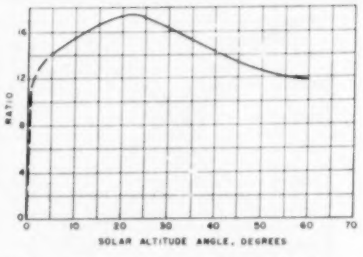

Fig. 8—Ratio of direct solar radiation at normal incidence to diffuse sky radiation incident upon a south-facing vertical surface during typical winter cloudless days

Sample calculations are also provided.

It is interesting to compare the results of Table 3 with those of Table 2. Such a comparison indicates that depletion by the atmosphere is greatest at the lowest altitude angles where the length of path of the sun's rays through the atmosphere is longest. At 8 a.m. and for a horizontal surface, approximately 42 percent of the solar energy available outside the atmosphere is depleted by the atmosphere when the altitude angle is 6 deg, and at 12 noon, only 19 percent is depleted when the altitude angle is 26 deg, 49 min. The relative depletion for a south-facing vertical surface is even greater than that for a horizontal surface. At 8 a.m., about 67 percent of the available solar radiation is depleted by the atmosphere, and at 12 noon, about 30 percent is depleted.

An important conclusion may also be made regarding the relative amount of radiation which is incident upon an east-facing or west-facing surface during cloudless days. Such a surface is sunlit only a little more than 4 hrs on January 15 at 42 deg north latitude or half the time of illumination of the south-facing vertical surface. In addition, for those hours when the angular effect of the sun's rays is most favorable, the relative depletion by the atmosphere is greatest. It is evident that an east-facing or west-facing surface is quite ineffective for collection of winter sunshine.

Once hourly rates of solar and sky radiation incident upon a particular surface during cloudless days have been calculated, the daily totals may be found by application of Simpson's rule. Calculations were carried out at weekly intervals for the period October 1 to May 1 for 42 deg north latitude for a horizontal surface and for a south-facing vertical surface. The daily totals thus determined are shown in Fig. 9 together with the curve for the daily total direct solar radiation incident upon a south-facing vertical surface outside the atmosphere. The curve for daily total solar and sky radiation incident upon a south-facing vertical surface during cloudless days has a rather unusual shape. As December 21 is approached from either side, the angular effect of the sun's rays becomes more favorable for interception of direct solar radiation by a south-facing surface. However, at the same time, depletion by the atmosphere increases, due to the lower altitude angles of the sun. Sky radiation values also decrease as December 22 is approached, and these two effects combine to indicate the two peaks for this curve.

Solar and Sky Radiation Available in United States at Earth's Surface During All Days

General Factors Affecting Availability of Radiation. Although it is possible to calculate, with considerable accuracy, the total amount of

Table 3—Distribution of Solar and Sky Radiation, Btu per (hour) (square foot). Incident upon Horizontal and South-facing Vertical Surfaces on the Earth during Cloudless Days on January 15 at 42 deg North Latitude

Sun Time	Altitude β Deg Min	Wall Solar Azimuth Deg-Min	Normal Incidence Radiation I_o	Horizontal Surface[a] Direct Solar Radiation I_D	Horizontal Surface[a] Sky Radiation I_S	Horizontal Surface[a] Total Radiation I_T	South-facing Vertical Surface[b] Direct Solar Radiation I_D	South-facing Vertical Surface[b] Sky Radiation I_S	South-facing Vertical Surface[b] Total Radiation I_T
7:00 a.m.	—	—	—	—	—	—	—	—	—
8:00	6 0	54 18	126	13.1	15.4	28.5	73.1	8.8	81.9
9:00	14 22	42 54	232	57.5	24.5	82.0	164.7	14.0	178.7
10:00	20 59	30 0	266	95.2	26.8	122.0	215.2	15.3	230.5
11:00	25 18	15 30	280	119.6	28.2	147.8	244.2	16.3	260.5
12:00	26 49	0 0	286	129.0	28.6	157.6	255.1	16.8	271.9
1:00 p.m.	25 18	15 30	280	119.6	28.2	147.8	244.2	16.3	260.5
2:00	20 59	30 0	266	95.2	26.8	122.0	215.2	15.3	230.5
3:00	14 22	42 54	232	57.5	24.5	82.0	164.7	14.0	178.7
4:00	6 0	54 18	126	13.1	15.4	28.5	73.1	8.8	81.9
5:00	—	—	—	—	—	—	—	—	—

[a]Sample calculations for 12:00 o'clock are shown below:

I_o = 286 Btu per (hr) (sq ft) from Fig. 6.

$I_D = I_o \sin \beta$ = (286) (0.451) = 129 Btu per (hr) (sq ft).

I_D/I_S = 4.5 from Fig. 7.

I_S = 129/4.5 = 28.6 Btu per (hr) (sq ft).

$I_T = I_D + I_S$ = 157.6 Btu per (hr) (sq ft).

[b]Sample calculations for 12:00 o'clock are shown below:

I_o = 286 Btu per (hr) (sq ft) from Fig. 6.

$I_D = I_o \cos \beta \cos \alpha$ = (286) (0.892) (1.0) = 255.1 Btu per (hr) (sq ft).

I_o/I_S = 17 from Fig. 8.

I_S = 286/17 = 16.8 Btu per (hr) (sq ft).

$I_T = I_D + I_S$ = 271.9 Btu per (hr) (sq ft).

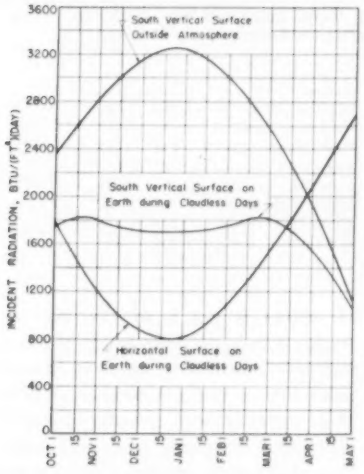

Fig. 9—Daily total solar and sky radiation incident upon horizontal and south-facing vertical surfaces at 42 deg north latitude

solar radiation available outside the atmosphere and the total amount of solar and sky radiation available at the earth's surface during cloudless days, these calculations are primarily of value in guidance in solar energy studies, and are of little value in engineering design of systems for winter collection of solar energy. The effect of clouds on depletion of radiation is probably the greatest single deterrent to the theoretical estimation of actual radiation available. There is no mathematical way to estimate the depletion of radiation by clouds since the amount and type of cloudiness cannot be predicted. Therefore, it is necessary to combine theoretical considerations with actual recorded solar and sky radiation values at different locations in order to predict the engineering availability of solar energy with even exploratory accuracy.

The number of hours of sunshine and percentage of possible hours for the months of December and January are shown in Table 4 for several cities. This table illustrates the widely varying amounts of sunshine in the United States, with December extremes of 45 hr and 16 percent for Erie, Pa. to 254 hr and 82 percent for Yuma, Ariz. *Technical Paper No. 12* of the U.S. Weather Bureau[12] presents these data for approximately

Table 4—Average Number of Hours of Sunshine and Percentage of Possible Sunshine Hours for Typical Cities during December and January

City	December Hours	December Percent	January Hours	January Percent
Boston, Mass.	134	48	144	49
Cleveland, Ohio	68	24	86	29
Erie, Penn.	45	16	65	22
Lincoln, Neb.	154	54	171	57
Los Angeles, Calif.	220	72	219	70
Madison, Wis.	101	36	125	43
Miami, Fla.	211	65	213	65
Nashville, Tenn.	127	42	136	43
New Orleans, La.	146	46	161	49
Sault Ste. Marie, Mich.	57	21	77	27
Seattle, Wash.	58	22	71	26
Yuma, Ariz.	254	82	257	81

200 cities in the United States. An interesting observation from this publication is that regions immediately south of the Great Lakes, including such cities as Erie and Cleveland, have relatively low amounts of winter sunshine due evidently to cloud formations originating over the Great Lakes. It is also observed that the majority of the stations reported in Washington and Oregon show very low amounts of sunshine in December and January. Thus, these two regions, the Great Lakes and the Pacific Northwest, are relatively poor locations for utilization of winter sunshine. For the country as a whole, excepting these two regions and the southwestern part of the country, about 50 percent of possible sunshine appears normal for December and January.

Atmospheric pollution such as smoke and dust constitute another factor difficult to take into consideration. During a dust storm, incident radiation may be reduced by 90 percent or more.[13] The quantity of dust in the atmosphere over cities may depend to some extent on the state of economic prosperity. During the depression year of 1932, smoke and dust from manufacturing causes were reduced and there was a marked increase in solar radiation recorded at Weather Bureau stations.[14]

Although limited in extent, actual recorded daily totals of solar and sky radiation as received at various stations of the U.S. Weather Bureau are more revealing and more significant in guiding engineering calculations than are vast amounts of inadequate theoretical calculations. Table 5 lists the U.S. Weather Bureau's network of stations recording such data for a horizontal surface, as well as the year in which the records were begun. The oldest solar station is Madison, Wis., started in 1911. Of the 54 stations listed in Table 5, 29

Table 5—U.S. Weather Bureau Stations Which Record Daily Totals of Solar and Sky Radiation Received by a Horizontal Surface, and Year Records were Begun

Station	Year	Station	Year	Station	Year
Albuquerque, N. M.	1949	Griffin, Ga.	1950	North Head, Wash.	1949
Apalachicola, Fla.	1949	Hatteras, N. C.	1949	Oak Ridge, Tenn.	1949
Atlanta, Ga.	1949	Indianapolis, Ind.	1949	Phoenix, Ariz.	1949
Blue Hill, Mass.	1933	Inyokern, Calif.	1948	*Put-in-Bay, Ohio	1942
Boise, Idaho	1949	Ithaca, N. Y.	1954	Rapid City, S. D.	1949
Boston, Mass.	1944	*La Jolla, Calif.	1928	Riverside, Calif.	1933
Brownsville, Tex.	1949	Lake Charles, La.	1949	Salt Lake City, Utah	1946
Charleston, S. C.	1949	Lander, Wyo.	1949	Sault Ste. Marie, Mich.	1950
*Chicago, Ill.	1923	Las Vegas, Nev.	1949	Santa Maria, Calif.	1949
Columbia, Mo.	1944	Lincoln, Neb.	1916	Sayville, N. Y.	1949
Columbus, Ohio	1948	Lynn, Mass.	1949	Seabrook, N. J.	1949
Davis, Calif.	1942	Madison, Wis.	1911	Seattle, Wash.	1950
East Lansing, Mich.	1942	Medford, Ore.	1949	St. Cloud, Minn.	1949
East Wareham, Mass.	1942	Miami, Fla.	1949	State College, Pa.	1941
El Paso, Tex.	1949	Nashville, Tenn.	1942	Stillwater, Okla.	1950
Fort Worth, Tex.	1949	*New Orleans, La.	1928	*Twin Falls, Idaho	1927
Fresno, Calif.	1928	New York, N. Y.	1924	Upton, N. Y.	1950
Grand Lake, Colo.	1948	Newport, R. I.	1937	Washington, D. C.	1914

*Publication discontinued.

started their solar observations in 1949 or later. Unfortunately, only one station (Blue Hill, Mass.) has recorded radiation received on a south-facing vertical surface, as well as on a horizontal surface, and these records were begun in 1945.

The Weather Bureau has adopted the Eppley thermoelectric pyrheliometer as its standard recording instrument. Until July of 1941, the weekly means of daily total radiation recorded by the Weather Bureau stations were published in *Monthly Weather Review*. From July 1941 through December 1949, the daily totals appeared in the same publication, and since January 1950, the daily totals have been published in *Climatological Data, National Summary*.

Average Solar and Sky Radiation Available on a Horizontal Surface. Table 6 shows the monthly means of daily radiation for December and January obtained by those stations with records of 10 years or longer. The unit indicating the extent of radiation in Table 6 is the langley or one gram-calorie per square centimeter. The entries in Table 6 may be converted to Btu per square foot per day by multiplying them by 3.69.

Fritz and MacDonald[15] have carried out calculations permitting construction of monthly maps showing isolines of average solar and sky radiation received by a horizontal surface in the United States during all days. This was possible since it was determined that a linear relationship existed between the ratio of actual to cloudless day radiation and the percent of possible sunshine. Since the number of hours of sunshine instrumentally recorded was available for a large number of localities based on many years of records, the calculation of actual radiation in those sections where pyrheliometer studies had not been made was permitted.

Table 6—Monthly Means of Daily Total Solar and Sky Radiation Received by a Horizontal Surface in Langleys per Day for December and January

Station	Dec.	Jan.	Station	Dec.	Jan.
Blue Hill, Mass.	135	153	Madison, Wis.	119	149
Chicago, Ill.	87	106	Nashville, Tenn.	132	138
Davis, Calif.	146	191	New Orleans, La.	200	215
East Lansing, Mich.	88	101	New York, N. Y.	119	129
Fresno, Calif.	158	182	Riverside, Calif.	216	257
Ithaca, N. Y.	103	116	State College, Pa.	120	130
La Jolla, Calif.	228	252	Twin Falls, Idaho	124	166
Lincoln, Neb.	166	187	Washington, D. C.	159	163

Average Solar and Sky Radiation Available on a South-facing Vertical Surface at Blue Hill, Mass. The observatory at Blue Hill, Mass. is the only weather station in the United States which has made actual measurements of solar energy incident upon a south-facing vertical surface. These measurements of the daily total solar and sky radiation plus the radiation reflected from the ground were begun in March, 1945. Fig. 10 shows a graph of the average weekly means of daily totals of solar and sky radiation received by a south-facing vertical surface at Blue Hill, together with graphs of maximum and minimum recorded radiation at the same location. The curves for calculated radiation with no atmosphere at 42 deg north latitude and for calculated radiation at the earth's surface during cloudless days at 42 deg north latitude are shown on the same graph. The latitude at Blue Hill is 42 deg, 13 min north.

It is interesting to note from Fig. 10 that the maximum curve for Blue Hill is consistently higher than the curve for calculated radiation during cloudless days. This excess may be attributed to the albedo of the ground—the reflection of radiation from the ground cover and the interception of a part of this radiation by the south-facing vertical surface. The sharp increase of the maximum curve during the period December 15 to March 15 is apparently caused by an increase of the albedo by ground snow cover. It is significant

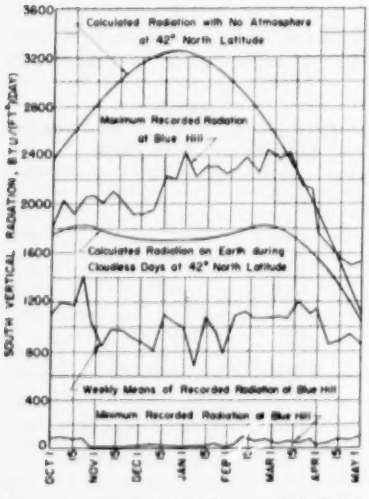

Fig. 10—Calculated and recorded daily radiation incident upon a south-facing vertical surface

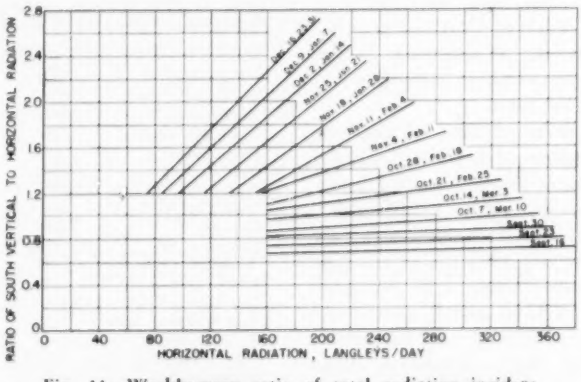

Fig. 11—Weekly-mean ratio of total radiation incident upon a south-facing vertical surface to that incident upon a horizontal surface at Blue Hill, Mass.

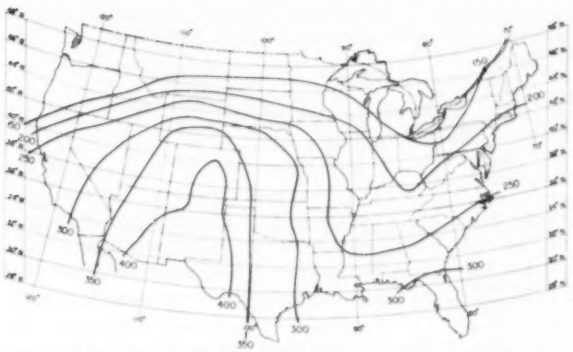

Fig. 12—Estimated average solar and sky radiation in langleys per day incident upon a south-facing vertical surface in December

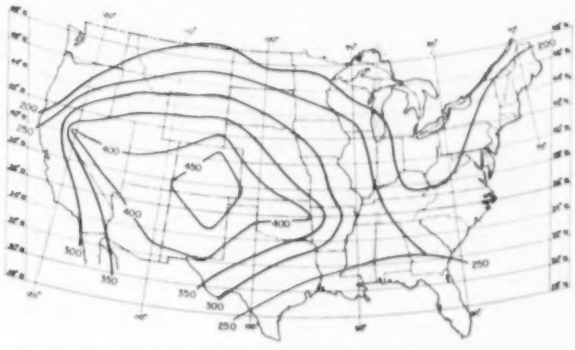

Fig. 13—Estimated average solar and sky radiation in langleys per day incident upon a south-facing vertical surface in January

that during March and April some of the values of the maximum curve of recorded radiation exceeded those of the calculated curve for no atmosphere.

Fig. 11 shows a series of lines for different weeks of the winter season representing the weekly mean ratio of south-vertical to horizontal radiation at Blue Hill as a function of radiation incident upon a horizontal surface. Although there was some scattering of points, reasonably good correlation was obtained with the linear relationships shown.

Estimated Average Solar and Sky Radiation Available on a South-facing Vertical Surface in the United States. The recorded data at Blue Hill for a south-facing vertical surface may be considered representative of other localities at 42 deg north latitude with reasonably dust-free atmospheres and with about 50 percent sunshine during December and January. Because of variation in cloudiness, atmospheric pollution, and latitude, any extension of Blue Hill data to other parts of the country must be recognized as only an approximation.

Of the several methods considered for extension of the Blue Hill data, the one which showed the most promise involved the use of the known distribution of radiation received by a horizontal surface as presented by Fritz and MacDonald together with the south-vertical to horizontal ratio shown in Fig. 11. Table 7 shows dates for Blue Hill which have similar solar altitude and azimuth angles to December 15 and January 15 at various other north latitudes. Although the similarity of angles is not exact in each case, close agreement exists.

Table 7—Dates at Blue Hill, Mass. Which Have Similar Solar Altitude and Azimuth Angles as December 15 and January 15 at Other North Latitudes

North Latitude Deg	Dec. 15	Jan. 15
30	Nov. 1	Oct. 15
36	Nov. 15	Nov. 8
42	Dec. 15	Jan. 15
48	Dec. 22	Dec. 22

Fig. 12 shows the estimated average daily solar and sky radiation incident upon a south-facing vertical surface in the United States during December, and Fig. 13 presents a similar map for January. Figs. 12 and 13 were constructed in the following manner: For a given locality, the horizontal radiation was found from the appropriate map of Fritz and MacDonald. For the known latitude of the locality an equivalent date for Blue Hill was obtained from Table 7. Using this equivalent date, a ratio of south-vertical to horizontal radiation was found from Fig. 11. Multiplication of this ratio by the known horizontal radiation gave the estimated incident radiation upon a south-facing vertical surface. This procedure was carried out for approximately 100 localities for both December and January and the isolines of Figs. 12 and 13 were drawn. By this procedure, the cloudiness and atmospheric pollution peculiarities of a particular region are largely accounted for, since the horizontal radiation used was developed from actual recorded data. Variation in the sun's angular position is taken into consideration by the equivalent data determined from Table 7. The albedo of the ground varies somewhat at different locations, particularly where a snow cover is involved, but any error so introduced is of secondary magnitude. Thus, these maps provide reasonably correct data for gross engineering design calculations.

It is interesting to note from Figs. 12 and 13 that a relatively low amount of radiation is available on a south-facing vertical surface in the regions southeast of the Great Lakes and in the Pacific Northwest. For a given latitude, the available radiation is larger for those states west of the Mississippi River and reaches a maximum in the Rocky Mountains. For both December and January, the maximum radiation appears to be centered in the states of Colorado and New Mexico.

Analysis of Weather Bureau Records for Madison, Wis.; Lincoln, Neb.; Nashville, Tenn.; and New Orleans, La. In the articles of this series yet to be published, four locations were chosen for study of the comparative design considerations involved in the utilization of solar energy as a partial or total heat source for the heat pump. These locations are Madison, Lincoln, Nashville, and New Orleans. Al-

though Figs. 12 and 13 present reasonable approximations to the solar and sky radiation available on a south-facing vertical surface for the months of December and January, additional solar statistics are needed for engineering design purposes. From the standpoint of utilization of solar energy for house heating, additional important solar statistics are the possible deviation from the long-time normal radiation for the months of December and January, the sequence of days with above-average and below-average radiation, and the distribution of days in the months of December and January with above-average and below-average radiation. In addition, it is informative to know the distribution of degree-days with various ranges of radiation.

Maria Telkes[16] has carried out some analyses for Blue Hill, Mass. In this section the results of U.S. Weather Bureau records studies for Madison, Lincoln, Nashville, and New Orleans are discussed. The following number of years of records were examined for each of the localities: Madison, 21 years, Lincoln, 21 years, Nashville, 10 years, and New Orleans, 12 years.

Table 8 presents the average monthly percent deviation from daily normal radiation received by a horizontal surface at the four localities in December and January and shows the wide variation in radiation that may be expected. Extremes for Madison are a surplus of 41.5 percent and a deficiency of 33.2 percent, for Lincoln a surplus of 18.3 percent and a deficiency of 32.3 percent, for Nashville a surplus of 26.4 percent and a deficiency of 26.3 percent, and for New Orleans a surplus of 34.4 percent and a deficiency of 29.5 percent.

Table 9 presents the average distribution of days in December and January with less than threshold radiation, with total daily radiation between the threshold value and the monthly average, with total daily radiation between the monthly average and 50 percent greater than monthly average, and with total daily radiation more than 50 percent greater than monthly average. The threshold value was chosen as 40 langleys per day for the south-facing vertical surface for Madison, Lincoln, and Nashville and is assumed to be the daily total radiation below which no useful collection of solar energy would result in a system using a heat pump. No threshold value was selected for New Orleans since it would be a rare day when no solar energy could be collected. Justification for these threshold values will be presented in forthcoming articles concerning the performance of solar collectors. Table 9 shows relatively few days on the average when no radiation could be collected, except in the case of Nashville. As shown, Nashville has between 10 and 11 such days on the average and, in this respect, Nashville is an unfavorable locality for winter utilization of solar energy. Table 9 also shows that Nashville has relatively few partly cloudy days and that either very dark days or clear days are usually to be expected.

A study was made to determine for the four localities the sequences of December and January days with less than threshold radiation, with less than monthly average radiation, and with greater than monthly average radiation. This information is necessary in estimating the amount of heat storage required for a house heating system utilizing solar energy. This study indicated that on a basis of 21 years of data, Madison had one eight-day sequence of December days with less than threshold radiation and as many as 23 consecutive days with daily radiation less than the January average; on a basis of 21 years of data, Lincoln had one eight-day sequence of January days with

Table 9—Average Distribution of Days in December and January with Various Ranges of Radiation as Received by a Horizontal Surface[a]

City	December				January			
	Range A	Range B	Range C	Range D	Range A	Range B	Range C	Range D
Madison	6	9	5	11	5	11	4	11
Lincoln	4	10	6	11	4	9	5	13
Nashville	11	4	3	13	10	6	3	12
New Orleans	—	14	7	10	—	16	8	7

[a]Range A denotes total daily radiation less than threshold value.
Range B denotes total daily radiation between threshold value and monthly average.
Range C denotes total daily radiation between monthly average and 50 percent greater than monthly average.
Range D denotes total daily radiation more than 50 percent greater than monthly average.

Table 8—Per cent Deviation from Normal Daily Radiation Received by a Horizontal Surface during December and January at Madison, Lincoln, Nashville and New Orleans

Year	Madison		Lincoln		Nashville		New Orleans	
	Dec.	Jan.	Dec.	Jan.	Dec.	Jan.	Dec.	Jan.
1951	−1.0	10.7		18.3		9.3		
1950	28.1	−8.9	6.4	−0.5	0.7	−9.1		
1949	2.8	−16.4	−2.3	−25.9	20.7	−26.3		
1948	18.4	14.9	−6.1	12.4	10.1	26.4		
1947	39.1	3.0	0.4	18.0	11.6	−16.3		
1946	3.0	4.7	5.1	−2.9	12.5	−13.3	13.4	−4.1
1945	10.1	−4.7	−8.3	−23.5	−17.2	−15.6	8.1	
1944	12.1	0.2	−3.9	11.3	−22.7	14.3		16.5
1943	41.5	11.7	18.3	−1.5	−3.5	14.2	5.5	
1942	−14.2	9.0	−32.3	−10.5	−22.7		4.3	34.4
1941	−17.8	−19.1	−19.3	−26.8			10.0	13.6
1940	−22.7	2.7	−29.4	15.4			−9.7	7.0
1939	9.9	−16.1	7.2	1.1			21.4	18.1
1938	−6.5	−22.6	15.1	−3.5			8.1	−1.3
1937	−20.0	−9.9	−1.3	12.7			−5.6	−18.7
1936	16.4	3.7	−10.5	−8.8			−21.4	−1.3
1935	−20.2	−9.5	−25.6	2.0			0.9	0.0
1934	−7.7	−18.1	−7.2	−8.5			6.7	−13.4
1933	−17.0	−12.4	5.7	7.3			6.3	−20.7
1932	−0.4	−33.2	12.7	−5.7			−29.5	−26.7
1931	−23.7	−10.4	−26.6	14.6				

less than threshold radiation and as many as eleven consecutive days with less than the January average; on a basis of 10 years of data, Nashville had one sequence of 11 days with less than threshold radiation; and, on a basis of 12 years of data, New Orleans had one sequence of 16 December days with less than average radiation. This investigation indicated that sequences of very dark days with less than threshold radiation are more frequent at Nashville than at any of the other three cities. Fortunately, except in the case of Nashville, sequences of days with above-average radiation are more common than sequences with less than average radiation. This is an important advantage in systems designed to utilize solar energy and employing heat storage.

A study was made to determine the distribution of degree-days with various ranges of horizontal radiation at the four localities. Two important conclusions were drawn from this study. Days which have more than the average number of degree-days are usually days with above-average radiation. This is particularly true for very cold days. Furthermore, those days with less than threshold radiation are often days having less than the average number of degree-days.

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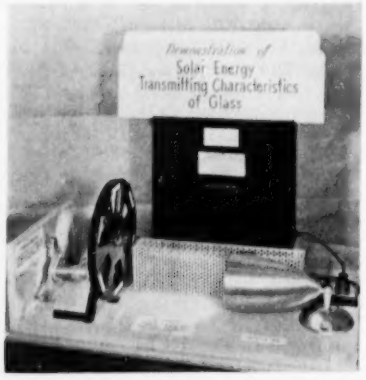
SOCIETY RESEARCH DEMONSTRATIONS AT *ASRE* MEETING

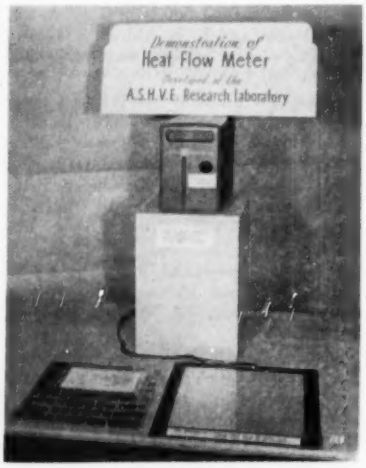


ASHVE research demonstrations of solar energy transmitting characteristics of glass at *ASRE* meeting in Washington, D.C.

One of the highlights of the 49th Annual Meeting of the *American Society of Refrigerating Engineers*, held at the Shoreham Hotel, Washington, D.C., December 6-9, 1953, was the Technical Research Exhibit. This exhibit featured demonstrations of research into the future and displays of machines of the past. Two demonstrations sponsored by the ASHVE were a low-inertia low-resistance heat flow meter, developed at the ASHVE Research Laboratory, Cleveland, and solar energy transmitting characteristics of glass. These two exhibits were prepared by the ASHVE, under the direction of C. M. Humphreys, acting director, and shown by staff members of the Society's Research Laboratory.

A demonstration of the methods and findings of the studies in the physiological effects of environment, based on work done at the College of Medicine at the University of Illinois, was presented in a display prepared by the Departments of Mechanical Engineering and Medicine of the University.

The studies have been a part of a comprehensive program of research conducted by the University of Illinois in cooperation with the ASHVE and the U.S. Public Health Service.



Heat flow meter developed at ASHVE Research Laboratory at exhibition at *ASRE* meeting, Washington, D.C.

Personals

W. A. GRANT, Syracuse, N.Y., has been elected a vice president of Carrier Corp. and will head the new Central Engineering Staff. Mr. Grant has established an international reputation as an authority in air conditioning research and development and engineering. With Dr. W. H. Carrier and R. E. Cherne, he was co-author of the recently revised text book and basic engineering guide, *Modern Air Conditioning, Heating and Ventilating*. . . . FRED KAISER has been appointed manager of the Eastern region of Minneapolis-Honeywell Regulator Co., with headquarters in New York, and S. L. FURBER has been appointed sales manager of its Commercial Building Market Section of its Commercial Division, and will supervise sales and training activities in its office, store, restaurant and theater field. . . . . M. E. MOONEY has joined Typhoon Air Conditioning Co., Inc., Brooklyn, N.Y. as vice president in charge of sales. He was formerly vice president and sales manager of Baker Refrigeration Corp., South Windham, Me. . . . . C. M. TOELAER has been appointed manager of commercial engineering of General Electric Co.'s home heating and cooling department, Bloomfield, N. J.

Pressure Loss of Air Flowing Through 45-Degree Wooden Louvers

By P. R. Cobb*, College Station, Tex.

SUMMARY — Although the use of louvers for applications such as shielding devices for light, wind, rain, cooling tower walls, and ventilating ports in buildings is well known, there is little published information on louver‡ resistance. This paper evaluates the effect of different variables on the pressure loss in 45-deg wooden louvers of common construction encountered in practice.

THE RESISTANCE of louvers to air flow is important whenever any air moving device is to operate in conjunction with one or more sets of louvers. Most stationary louvers today are 45-deg louvers. Therefore, the pressure drop through this type of louver is of particular interest.

Despite the widespread use of louvers in applications such as shielding devices for light, wind and rain; cooling tower walls; and to cover ventilation ports in homes and buildings, there seems to be little published material on louver resistance to air flow. The first results from a research program of the Texas A. and M. College Engineering Experiment Station evaluating the effect of different variables on pressure loss in 45-deg wooden louvers are therefore presented.†

Equipment

The test equipment illustrated in Figs. 1 and 2 consisted of a fan, plenum chamber, and inlet duct. The 24-in. centrifugal fan driven by a 2 hp motor discharged air through the duct into the plenum chamber. This chamber, 7 ft high, 11 ft long, and 7 ft wide, contained five concentric cone diffusers designed to distribute the air uniformly and to give to the chamber the characteristics of a large room. Connected to the exhaust side of the plenum chamber was a duct having a rounded entrance and measuring 3 sq ft in area and 4.5 ft in length. The various louvers tested were attached to the outlet end of this duct.

The air flow rate was controlled by vanes on the inlet side of the fan. Air flow measurements were made in one of two 11 ft long, 13 in. diameter ducts used for connecting the fan to the plenum chamber. One of these ducts contained a 6 in. throat diameter nozzle which was used for measuring low rates of air flow. The nozzle manometer was connected between an upstream static tap in the duct and a tap in the throat of the nozzle. The second duct was equipped for Pitot tube measurements and was used for the higher rates of flow. In the 3 sq ft inlet duct to the louver, a static pressure tap was located 2 ft in front of the louver. This tap was connected to the pressure side of a zero-to-one inch inclined scale manometer. The other side of the manometer was vented to the atmosphere. The pressure indicated on this manometer was the static pressure loss of the air flowing through the louver.

Barometric pressure was read from a mercury column barometer and corrected to the standard conditions of the U. S. Department of Commerce Weather Bureau, namely 45 deg latitude, sea level, and 32 F temperature.

Temperature measurements were made with two 0 to 120 F mercury-in-glass thermometers. The thermometers were placed at the intake side of the fan, one indicating the dry-bulb temperature and the other the wet-bulb temperature.

The louvers (Fig. 2) were made up of boards that had a planed surface and were 20.78 in. long and 0.81 in. thick. The edge of each louver board was beveled to a 45-deg angle, thus making the leading surface of each board perpendicular to the air stream. By changing the number of boards in each louver from three to 17, the free area ratio was varied from 0.8893 to 0.1148. All louvers had the same overall width, 4.37 in. in the direction parallell to the flow of incoming air.

Experimentation

Because of the relative ease of data calculation, the flow nozzle method of air flow measurement was used whenever possible. As the free area increased, fewer test runs were possible with this method. The louver with the largest free area permitted only three test runs to be made by the nozzle method while the smallest free area test was made entirely by the nozzle method. One test was run completely with the nozzle and then over again with the Pitot traverse. The difference in the results was found to be negligible (see Table 1).

When the nozzle was used for measurement of air flow, two sets of

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*Research Assistant, Texas Engineering Experiment Station.

†Based on the author's thesis submitted to the Graduate School of A. & M. College of Texas in fulfillment of a requirement for an M.S. in M.E.

For presentation at the 60th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Houston, Tex., January 1954.

‡An opening through which air is delivered and consists of a series of overlapping, sloping boards, slats or the like.

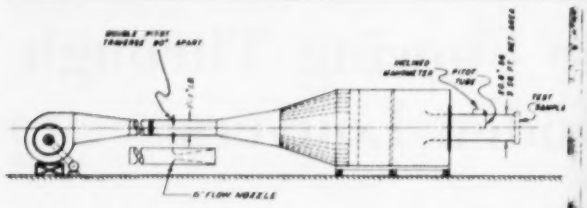

Fig. 1—Arrangement of test equipment for resistance measurements

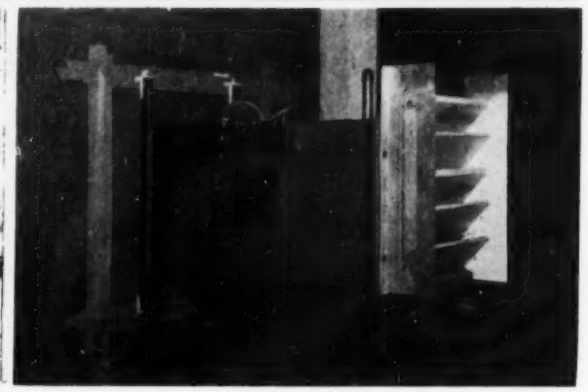

Fig. 2—Inlet duct and louvers for testing

temperature and pressure drop readings were made after the system reached steady flow. When the Pitot tube was used for measuring air flow, three sets of temperature and pressure drop readings were obtained—one at the beginning of the test when the system had reached steady flow, one halfway through the Pitot tube traverse, and one at the end of the traverse. Averages obtained from these readings were used in subsequent calculations.

Each louver was tested at different rates of air flow adjusted to give increments of pressure drop of about 0.1 in. of water. The number of tests on a particular louver depended upon the free area and the maximum rate of air flow available. The number varied from five for louvers with large free area to nine for louvers having small free area.

All manometers used in the test setup were calibrated with a micromanometer and a hook gage to 0.001 in. of water before being used. In the calculation of data these corrections were applied to all final manometer readings.

The velocity of approach air to the louvers was tested for uniformity of velocity front. The results of this test showed a velocity front with less than 5 percent variation throughout the center one-half of the test section. The velocity maintained this front until very close to the wall of the inlet duct where it dropped off sharply.

Leakage throughout the system was checked and found to be less than 1 percent of the air delivered by the blower. The method used to measure leakage was that outlined in a Texas Engineering Experiment Station Research Report.[1]

Analysis and Computation of Data

Dimensional Analysis:—The loss of pressure of air flowing through a louver obviously depends upon the dimensions of the louver, the quantity of air flowing, and upon certain properties of the air such as density and viscosity. At constant atmospheric pressure, density and viscosity are functions chiefly of the temperature of the air. For this analysis, seven possible variables were considered. These are listed with their respective symbols and dimensions as follows:

A'/A = ratio of free area to face area, dimensionless.
V = velocity of the approach air to the louver, Length/Time
μ = viscosity of air flowing, Mass/(Length) (Time)
ρ = density of air flowing, Mass/(Length)^3
P = pressure loss of air flowing through the louver, Mass/(Time)^2 (Length)
R = hydraulic radius of the louver, Length
ϕ = angle made with the vertical by the center line of a louver board, dimensionless.

Using dimensional analysis[2] to group the variables, it was found that there are four dimensionless groups satisfying the Buckingham Pi Theorem. These four groups are:

$\pi_1 = P/\rho V^2$
$\pi_2 = RV\rho/\mu$
$\pi_3 = A'/A$
$\pi_4 = \phi$

In this investigation the louver board slope, or the angle Φ, was constant (45-deg), so π_4 was the same for all tests. The free area ratio was varied by changing the number of louver boards so that π_3 varied from 0.1148 to 0.8893.

Calculation of Velocity:—The approach of the air entering the louver was calculated by first finding the

Nomenclature

A = face area or total area covered by the louver in a plane perpendicular to the approach air, square feet.
A' = free area or area in the louver open to the flow of air in a plane perpendicular to the approach air, square feet.
A'/A = ratio of free area to face area, dimensionless.
g = local acceleration due to gravity, approximately 32.11 feet per (second) (second).
P = pressure loss of air flowing through the louver, pounds mass per foot minute squared = $(6\times10^5 \times$ pressure in inches of water*).
P_L = pressure loss of air flowing through the louver, inches of water.
P_L' = pressure loss of air flowing through the louver, corrected to a standard air density of 0.075 pounds mass per cubic foot, inches of water.
R = hydraulic radius of the louver, feet. The free area divided by the perimeter of the opening in a plane perpendicular to the air flow.
V = average velocity of the air flowing through the inlet duct, feet per minute.
ρ = density of air flowing, pounds mass per cubic foot.
ρs = density of standard air, 0.075 pounds mass per cubic foot.
μ = viscosity of air flowing, pounds mass per foot second.
ϕ = angle made with the vertical by the center line of a louver board, dimensionless.

*A unit of pressure equivalent to the pressure exerted by a 1 in. column of water to a density of 62.5 pounds mass per cubic foot.

[1]Exponent numerals refer to References.

volume rate of flow through the system and then dividing this rate by the area of the inlet duct. This gave the mean velocity of approach.

The volume rate of flow of air through the system was calculated for both the nozzle and Pitot tube method by means of the equation[3]

$$Q = 1096.5 KA\sqrt{\frac{h_v}{\rho}}$$

where

K = the coefficient of discharge multiplied by the velocity of approach correction factor (*for the nozzle*).
K = a traverse correction factor (*for the Pitot tube*).
h_v = velocity pressure, inches of water.
A = face area or total area covered by the louver in a plane perpendicular to the approach air, square feet.
ρ = the density of the air flowing, pounds mass per cubic foot.

The velocity pressure at the throat of the nozzle was read directly from an inclined scale manometer. For the Pitot tube, the velocity pressure used in the equation was the square of the average of the square roots of the traverse readings. The traverse consisted of 20 readings, 10 taken along a horizontal axis and 10 along a vertical axis of the duct and at the center of equal areas, according to recommended practice.[3]

Density:—The density of the air was obtained from a circular air density slide rule[4] developed by the Texas Engineering Experiment Station using the observed barometric pressure and the dry and wet bulb temperatures of the air.

The density of the room air for all tests ranged from 0.06752 to 0.07278, and depended upon normal ambient room conditions, except that the lowest density (0.06752) was obtained by warming the room artificially to about 110 F by means of a gas-fired furnace.

Hydraulic Radius: The hydraulic radius (R) was calculated from the dimensions of the louver. By changing the number of louver boards the value of the hydraulic radius was varied from 0.0097 ft to 0.266 ft.

Viscosity: The viscosity of the air was obtained from published tables.[5] Values of viscosity ranged from 123 x 10^{-7} to 127 x 10^{-7} pounds mass per ft sec.

Conversion Factors: In calculating the dimensionless groups $P/\rho V^2$ and $RV\rho/\mu$ from the observed and calculated quantities P_L, ρ, V, R, and μ it was necessary, because of inconsistent units, to use conversion factors.

P_L was expressed in inches of water, ρ in pounds mass per cubic foot, and V in feet per minute. The group $P_L/\rho V^2$ then had the dimensions inches of water minutes squared feet per pounds mass. The group, with these dimensions, was then multiplied by 6 x 10^3 in order to make the group dimensionless.

Similarly, R was expressed in feet, V in feet per minute, ρ in pounds mass per cubic foot and μ in pounds mass per foot per second. The group $RV\rho/\mu$ then had the dimensions seconds per minute and was divided by 60 in order to make the group dimensionless.

Graphical Representation of Data: It might be expected that for a given louver the most important variables affecting pressure drop are density and velocity, each of which appear in the dimensionless numbers π_1 and π_2. In analyzing the results of the tests, values of π_1 and π_2 were calculated from observed data and then plotted against each other (Fig. 3) to give a family of curves having π_3 as a parameter, π_4 being constant for all tests. From this plot equations were obtained giving the relationship between pressure drop, velocity, density, and free area ratio.

Analysis of Graphical Representation

From the plot of $P/\rho V^2$ against $RV\rho/\mu$ (Fig. 3) for values of the free area ratio above 0.5, the value of $P/\rho V^2$ for each louver tested was approximately constant (see Table 1). Below this value of free area ratio the different lines representing each louver were still straight, but as the free area ratio decreased the slope of the lines decreased.

For any test in the area of Fig. 3 comprising tests with a free area ratio greater than 0.5, a change in the group $RV\rho/\mu$ would not change

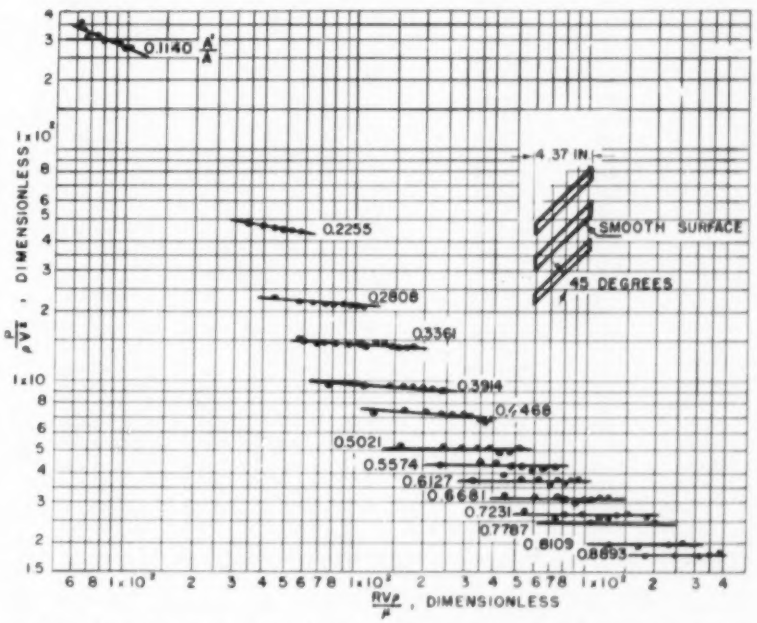

Fig. 3—Variation of $P/\rho V^2$ with $RV\rho/\mu$ for different values of ratios for free area to face area

Table 1—Tabulation of Data and Calculations on Tests of Pressure Loss of Air Flowing Through 45-Deg, Wooden Louvers

$\frac{\pi_3}{A'}$						$\frac{\pi_1}{P}$			$\frac{\pi_2}{R_r \rho}$
$\frac{A}{A}$	P_t	ρ	h_v	V	V^2	ρV^2	R	μ	μ
Dimensionless	In. of water	lb_m/ft^3	In. of water	ft/min	ft^2/min^2	Dimensionless	ft	lb_m/ft sec	Dimensionless
0.8895	0.110	0.07154	[a]N	7,106	722.4	521,900	1.764	0.2665	124×10^{-7}	1.851×10^4
	0.198	0.07145		12,719	967.1	953,300	1.774			2.475×10^4
	0.308	0.07145	[b]P	0.956	1220.	1,487,000	1.735			3.123×10^4
	0.397	0.07160		1.194	1361.	1,853,000	1.792			3.490×10^4
	0.501	0.07138		1.486	1522.	2,315,000	1.815			3.892×10^4
0.8109	0.127	0.07206	[a]N	7,272	728.1	530,100	1.987	0.1852	128×10^{-7}	1.292×10^4
	0.211	0.07206		12,587	958.1	917,900	1.914			1.700×10^4
	0.407	0.07205	[b]P	1.112	1310.	1,715,000	1.971			2.324×10^4
	0.497	0.07187		1.342	1441.	2,076,000	1.995			2.550×10^4
	0.548	0.07195		1.466	1505.	2,265,000	2.013			2.666×10^4
0.7787	0.098	0.06964	[a]N	4,423	577.7	333,700	2.528	0.1411	128×10^{-7}	7.448×10^3
	0.199	0.06980		9,296	836.6	699,800	2.430			10.81×10^3
	0.295	0.06975		13,965	1026.	1,052,000	2.405			13.25×10^3
	0.392	0.06961	[b]P	0.876	1183.	1,400,000	2.402			15.25×10^3
	0.485	0.06950		1.062	1303.	1,698,000	2.457			16.77×10^3
	0.591	0.06945		1.252	1416.	2,005,000	2.584			18.21×10^3
	0.694	0.06952		1.492	1545.	2,386,000	2.499			19.88×10^3
0.7254	0.098	0.07005	[a]N	4,023	549.3	301,700	2.760	0.1100	127×10^{-7}	5.550×10^3
	0.202	0.07009		8,750	809.7	655,700	2.632			8.188×10^3
	0.292	0.07008		12,595	971.7	944,100	2.636			9.823×10^3
	0.395	0.07024	[b]P	0.841	1154.	1,331,000	2.525			11.69×10^3
	0.493	0.07037		1.020	1269.	1,611,000	2.600			12.89×10^3
	0.584	0.07035		1.184	1367.	1,871,000	2.652			13.87×10^3
	0.706	0.07015		1.414	1497.	2,241,000	2.686			15.15×10^3
0.6681	0.114	0.07200	[a]N	4,047	543.4	295,300	3.211	0.0868	123×10^{-7}	4.563×10^3
	0.202	0.07200		7,305	730.3	533,300	3.156			6.140×10^3
	0.309	0.07215		11,362	909.7	827,500	3.106			7.657×10^3
	0.347	0.07186		12,942	972.7	946,200	3.058			8.152×10^3
	0.415	0.07186	[b]P	0.748	1076.	1,158,000	2.984			9.020×10^3
	0.502	0.07200		0.893	1175.	1,380,000	3.026			9.868×10^3
	0.600	0.07204		1.049	1272.	1,618,000	3.084			10.69×10^3
	0.718	0.07210		1.241	1384.	1,914,000	3.116			11.64×10^3
	0.846	0.07205		1.434	1488.	2,213,000	3.179			12.51×10^3
0.6127	0.111	0.07115	[a]N	3,358	498.0	248,000	3.764	0.0697	124×10^{-7}	3.292×10^3
	0.206	0.07115		6,134	673.0	452,900	3.828			4.449×10^3
	0.295	0.07110		8,960	813.6	662,000	3.755			5.374×10^3
	0.405	0.07110		12,475	960.3	922,100	3.699			6.343×10^3
	0.493	0.07119	[b]P	0.751	1083.	1,172,000	3.540			7.162×10^3
	0.582	0.07110		0.871	1167.	1,363,000	3.606			7.706×10^3
	0.684	0.07105		1.012	1259.	1,584,000	3.642			8.309×10^3
	0.784	0.07105		1.133	1331.	1,772,000	3.731			8.785×10^3
	0.909	0.07108		1.296	1424.	2,027,000	3.779			9.337×10^3
0.5574	0.099	0.07150	[a]N	2,588	436.1	190,200	4.357	0.0564	124×10^{-7}	2.366×10^3
	0.227	0.07150		5,747	649.8	422,300	4.495			3.522×10^3
	0.310	0.07146		8,082	761.6	580,000	4.477			4.127×10^3
	0.416	0.07146		11,075	902.4	814,300	4.280			4.889×10^3
	0.467	0.07170		12,588	960.4	922,400	4.225			5.218×10^3
	0.581	0.07145	[b]P	0.761	1088.	1,184,000	4.112			5.892×10^3
	0.709	0.07150		0.917	1194.	1,425,000	4.166			6.471×10^3
	0.788	0.07168		1.019	1257.	1,580,000	4.165			6.829×10^3
	0.931	0.07179		1.189	1356.	1,841,000	4.217			7.378×10^3
0.5021	0.089	0.06997	[a]N	1.923	380.0	144,400	5.247	0.0458	127×10^{-7}	1.596×10^3
	0.201	0.06995		4,370	572.9	328,200	5.231			2.406×10^3
	0.298	0.06994		6,564	702.2	493,100	5.158			2.950×10^3
	0.395	0.06989		8,817	813.9	662,500	5.103			3.417×10^3
	0.493	0.06990		11,075	912.2	832,200	5.064			3.831×10^3
	0.587	0.06988	[b]P	0.655	1021.	1,042,000	4.815			4.285×10^3
	0.700	0.06984		0.765	1104.	1,217,000	4.923			4.631×10^3
	0.791	0.06985		0.859	1169.	1,367,000	4.953			4.906×10^3
	0.891	0.06980		0.952	1231.	1,516,000	5.033			5.160×10^3
	0.971	0.06980		1.036	1285.	1,650,000	5.040			5.386×10^3
0.4468	0.108	0.07060	[a]N	1.685	354.2	125,400	7.276	0.0370	126×10^{-7}	1.224×10^3
	0.198	0.07059		3.039	475.6	226,200	7.399			1.644×10^3
	0.297	0.07055		4.669	589.7	347,700	7.248			2.037×10^3
	0.407	0.07055		6.451	693.1	480,400	7.182			2.394×10^3

[a]N Using 6 in. flow nozzle. [b]P Using 2, ten point Pitot traverses. $\pi_4(\phi)$ 45 deg for all tests.

the value of $P/\rho V^2$ for that test. This means that in this region $P/\rho V^2$ was independent of a change in $RV\rho/\mu$. Hence, the pressure loss was independent of the combined effect of viscosity of the air and hydraulic radius of the louver section since this was the only group in which μ and R appeared.

Table 1—Tabulation of Data and Calculations on Tests of Pressure Loss of Air Flowing Through 45-Deg. Wooden Louvers *(Concluded)*

$\frac{\pi_2}{A'/A}$	P_L	ρ		h_v	V	V^2	$\frac{\pi_3}{P/\rho V^2}$	R	μ	$\frac{\pi_1}{RV\rho/\mu}$
Dimensionless	In. of water	lb$_m$/ft^3		In. of water	ft/min	ft^2/min^2	Dimensionless	ft	lb$_m$/ft sec	Dimensionless
0.4468	0.504	0.07055	[a]N	8.013	772.6	596,900	7.157	0.0370	126×10^{-7}	2.669×10^{5}
	0.613	0.07054		9.905	858.9	737,700	7.040			2.966×10^{5}
	0.691	0.07055		11.248	915.2	837,500	6.991			3.161×10^{5}
	0.800	0.07025	[b]P	0.648	1013.	1,025,000	6.648			3.485×10^{5}
	0.889	0.07020		0.717	1066.	1,136,000	6.668			3.663×10^{5}
	0.968	0.07019		0.769	1104.	1,218,000	6.772			3.795×10^{5}
0.3914	0.094	0.06984	[a]N	1.108	288.7	83,350	9.615	0.0297	127×10^{-7}	7.851×10^{4}
	0.186	0.06984		2.220	408.7	167,000	9.551			11.12×10^{4}
	0.296	0.06984		3.525	515.0	265,200	9.543			14.01×10^{4}
	0.395	0.06984		4.765	598.8	358,500	9.434			16.29×10^{4}
	0.484	0.06983		5.818	661.7	437,800	9.461			18.00×10^{4}
	0.591	0.06983		7.198	736.0	541,700	9.346			20.03×10^{4}
	0.689	0.06983		8.491	799.3	638,900	9.226			21.75×10^{4}
	0.788	0.06987		9.880	861.9	742,900	9.077			23.46×10^{4}
	0.877	0.06980		10.944	907.6	823,800	9.177			24.69×10^{4}
0.3361	0.137	0.06802	[a]N	1.035	282.8	79,950	15.09	0.0256	130×10^{-7}	5.820×10^{4}
	0.191	0.06775		1.473	337.9	114,200	14.73			6.926×10^{4}
	0.278	0.06740		2.178	411.8	169,800	14.50			8.397×10^{4}
	0.404	0.06762		3.186	497.5	247,500	14.44			10.18×10^{4}
	0.475	0.06765		3.772	541.2	293,000	14.34			11.08×10^{4}
	0.602	0.06765		4.767	608.5	370,200	14.37			12.45×10^{4}
	0.696	0.06680		5.561	661.4	437,400	14.26			13.37×10^{4}
	0.783	0.06740		6.318	701.8	492,500	14.11			14.31×10^{4}
	0.880	0.06750		7.142	745.6	555,900	14.03			15.23×10^{4}
	0.988	0.06739		8.070	793.2	629,200	13.93			16.17×10^{4}
0.3361	0.133	0.07085	[a]N	1.014	274.2	75,180	14.89	0.0236	124×10^{-7}	6.114×10^{4}
	0.190	0.07080		1.485	331.7	110,000	14.59			7.389×10^{4}
	0.308	0.07080		2.426	424.3	180,000	14.44			9.449×10^{4}
	0.385	0.07075		3.032	474.5	225,200	14.45			10.56×10^{4}
	0.514	0.07074		4.056	548.9	301,300	14.44			12.21×10^{4}
	0.594	0.07081		4.704	590.8	349,000	14.37			13.16×10^{4}
	0.672	0.07079		5.352	630.3	397,200	14.29			14.04×10^{4}
	0.789	0.07071		6.358	687.3	472,400	14.13			15.29×10^{4}
	0.891	0.07067		7.267	734.9	540,100	13.98			16.34×10^{4}
	0.979	0.07065		8.054	774.0	599,000	13.85			17.20×10^{4}
0.2808	0.197	0.06994	[a]N	0.992	272.9	74,500	22.63	0.0185	127×10^{-7}	4.583×10^{4}
	0.295	0.06994		1.528	338.8	114,800	21.95			5.686×10^{4}
	0.395	0.06994		2.091	396.3	157,100	21.51			6.649×10^{4}
	0.492	0.06994		2.609	444.2	197,300	21.31			7.460×10^{4}
	0.593	0.06994		3.151	486.5	236,700	21.39			8.169×10^{4}
	0.685	0.07000		3.665	524.5	275,100	21.27			8.811×10^{4}
	0.791	0.07000		4.232	563.6	317,700	21.25			9.470×10^{4}
	0.887	0.07000		4.767	598.1	357,800	21.17			10.05×10^{4}
	0.986	0.07000		5.364	634.5	402,600	20.92			10.66×10^{4}
0.2255	0.380	0.07150	[a]N	0.903	257.6	66,360	47.95	0.0137	124×10^{-7}	3.400×10^{4}
	0.507	0.07144		1.235	301.4	90,840	46.76			3.962×10^{4}
	0.615	0.07144		1.526	335.0	112,200	45.94			4.408×10^{4}
	0.731	0.07144		1.857	367.5	135,100	45.36			4.852×10^{4}
	0.832	0.07144		2.117	394.6	155,700	44.80			5.189×10^{4}
	0.873	0.07144		2.243	406.2	165,000	44.40			5.341×10^{4}
	0.992	0.07144		2.557	433.6	188,000	44.23			5.704×10^{4}
0.1148	0.308	0.07271	[a]N	0.100	85.13	7,248	349.9	0.00617	125×10^{-7}	6.367×10
	0.462	0.07271		0.160	107.4	11,550	329.4			6.531×10
	0.577	0.07257		0.213	124.5	15,450	308.1			7.555×10
	0.705	0.07257		0.275	141.1	19,910	292.2			8.564×10
	0.870	0.07278		0.357	160.4	25,740	278.2			9.764×10
	0.954	0.07278		0.403	170.7	29,120	269.5			10.39×10
0.1148	0.473	0.07168	[a]N	0.169	111.2	12,350	319.9	0.00617	124×10^{-7}	6.665×10
	0.626	0.07168		0.239	132.3	17,500	299.1			7.930×10
	0.813	0.07171		0.329	155.2	24,110	281.6			9.308×10
	0.970	0.07171		0.406	172.4	29,730	272.6			10.34×10

[a]N Using 6 in. flow nozzle. [b]P Using 2, ten point Pitot traverses. $\pi_4(\phi)$ 45 deg for all tests.

With $P/\rho V^2$ independent of $RV\rho/\mu$ for 45-deg louvers with a free area ratio greater than 0.5 it was possible to graph $P/\rho V^2$ against A'/A with only the angle as a parameter. This led to the functional relationship,

$$P/\rho V^2 = f\,(A'/A) \quad \ldots\ldots\ldots\ldots (1)$$

When these constant values of $P/\rho V^2$ and the corresponding values of A'/A were plotted on log paper a straight line was obtained, the equation of which was $P/\rho V^2 = a(A'/A)^b$. Using the slope intercept formula solving for a and b, the

equation of the straight line expressing the functional relationship was:

$$P/\rho V^2 = 1.486\ (A'/A)^{-1.782} \quad \ldots\ldots(2)$$

This is a general equation, applicable in the region of the variables tested; relating the pressure drop, velocity, free area ratio, and density of air flowing through louvers with a free area ratio above 0.5.

By multiplying both sides of Equation 2 by the density of standard air and a conversion factor, the special equation for the pressure loss in inches of water can be shown to be:

$$P_L' = 1.855 \times 10^{-7}\ V^2\ (A'/A)^{-1.782} \quad \ldots\ldots(3)$$

For values of free area ratio below 0.5, the pressure loss at given conditions can be determined by calculating the value of the group $RV\rho/\mu$, and by finding the corresponding value of $P/\rho V^2$ for the particular free area ratio. The pressure loss may then be easily computed by using the value from the graph and the value of the density and velocity.

An equation for the sloping lines in the region of free area ratios below 0.5 was not written because of its cumbersome nature. The equation in functional form would appear as:

$$P/\rho V^2 = f_1\ (A'/A)\ f_2\ (RV\rho/\mu)\ f_3\ (A'/A) \quad \ldots\ldots(4)$$

Not only would this equation present difficulties in solving, but also, most louvers designed today have a free area ratio above 0.5. It is recommended that for free area ratios below 0.5 the graph be used, and for free area ratios above 0.5 the equation be used.

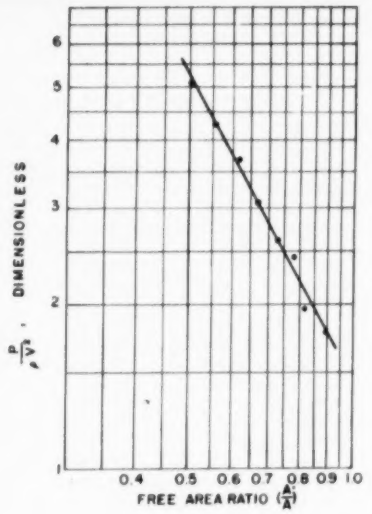

Fig. 4—Variation of $P/\rho V^2$ with ratios of free area to face area

Results and Conclusions

The results of this research were the determination of the principal variables and their influence on the pressure drop of air flowing through 45-deg wooden louvers.

1. The principal variable affecting pressure loss in 45-deg, wooden louvers with a free area ratio above 0.5 is the average velocity of the approach air. It can be seen from Equation 2, that with this type of louver the pressure loss varies as the square of the velocity.

2. The constant of proportionality between the pressure loss in inches of water referred to standard air and the velocity squared was equal to

$$1.855 \times 10^{-7}\ (A'/A)^{-1.782}$$

This dimensional constant was based on the slope and intercept of the straight line in Fig. 4.

3. The combined effect of the viscosity of the air and the hydraulic radius of the louver for 45-deg, wooden louvers with a free area ratio above 0.5 were found to be negligible. This conclusion was reached after the dimensionless group $P/\rho V^2$ was plotted as a constant for different values of the free area ratio.

The decreasing slope of the lines in Fig. 3 indicates that as the free area ratio decreased, the combined effect of the viscosity and the hydraulic radius on the pressure drop increased.

4. The decreasing slope of the lines in Fig. 3 also seems to indicate that the pressure loss approaches a linear function of the velocity as the free area ratio decreases.

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SMA Elects Officers

At the annual meeting of the *Stoker Manufacturers Association*, held in October in Cleveland, the following officers were reelected for the ensuing year: *President* — L. C. Dubs, president of Canton Stoker Corp., Canton, Ohio; *Vice President* — B. O. Fink, president of Auburn Foundry, Auburn, Ind.; and *Secretary-Treasurer* — H. B. Scoville, assistant manager of Cotta Transmission Co., Rockford, Ill.

One of the features of this one-day meeting, was a talk at the luncheon by R. L. Ireland, Jr., Cleveland, Ohio, chairman of the executive committee, Pittsburgh-Consolidation Coal Co., and chairman of the products promotion committee of the *National Coal Association*. Mr. Ireland described in detail the current plans and developments in the bituminous coal industry on the promotion of coal sales.

The members also heard complete details about one phase of the *NCA's* program when Marc G. Bluth, former *SMA* secretary, and now special field representative of the *NCA*, described the program known as the *NCA/ARCA Sales Engineering Council*, in which concentration of effort on commercial and small industrial steam plant business is under way in cooperation with retail coal merchants in a territory adjacent to Chicago in the three states of Illinois, Indiana and Michigan.

Other business transacted during this one-day meeting consisted of annual reports of the officers and committee chairmen, and at a meeting of the Board of Directors of *SMA*, it was unanimously voted to continue the Association's operations and functions on an active basis.

Automobile Air Conditioning — Progress and Problems

By P. J. Kent*, Detroit, Mich.

SUMMARY — This paper indicates some of the special problems to be overcome in designing air conditioning systems for cars, and shows how manufacturers have proceeded to provide suitable air conditioning. The application of air conditioning also affects the design of the engine cooling system, generator, etc., which must have the capacity to function properly under operating conditions imposed by the air conditioning system. The successful operation of these first systems, as well as the public demand for air conditioning, will insure a rapid development of special equipment having particular space-saving features.

BETWEEN THE YEARS of 1939 and 1953 approximately 10,500 cars have been air conditioned, but during this period none of the automobile companies had produced their own air conditioning system. However, during the past year several of the major companies have built systems of their own design for installation in their automobiles.

It can be fairly stated that none of the companies were able to supply the demand for air conditioning on their cars during the spring, summer and early fall months of 1953. Suppliers outside the automobile industry have also enjoyed an excellent market during the past year.

Additional automobile companies are planning to offer air conditioning in 1954, and those companies which had such systems in 1953 are planning greatly increased volume of production, so the prediction made in March that 10 percent of all new cars would be equipped with air conditioning within five to ten years would appear to be a pretty fair estimate. It has been definitely established that a large percentage of people living in the warmer sections of the country will pay the additional cost required to obtain air conditioning on the medium and high-priced cars.

Tooling for Air Conditioning

A year ago the problem of tooling and tool amortization was approached with considerable caution by production departments. Without knowing what the market would be or how stable the design might prove, there was considerable reluctance to spend money for expensive dies, molds and fixtures. As a result, many parts were partially fabricated by hand or machined from sand castings. In some cases, easily formed but expensive plastic parts were substituted for metal stampings with the net result that tooling costs were relatively low but piece prices high.

With every indication that the market will grow quite rapidly, a gradual change to mass production methods can be expected. However, this will not necessarily mean immediate price reduction, because while piece prices will drop, tool costs will increase. Only when production volume is achieved will the overall cost come down.

Air conditioning of offices and commercial establishments has had a very rapid growth in the last five or six years, and within the last two or three years the same trend in home air conditioning has been observed. If the progress of automobile air conditioning follows the same pattern, and there is every reason to believe it will, then appreciable price reductions based on savings resulting from mass production methods should be soon forthcoming.

Assembly Methods

In the plant the initial planning called for completing the car assembly on the regular assembly line and then delivering it to a special department where the modifications and assembly of air conditioning equipment were made. However, it was apparent that the major air conditioning units could be assembled in the car on the regular automobile assembly line leaving only the tubing assembly, charging and testing to be done in a special department.

Engineering the System

Operating experience with pre-war automobile air conditioning, and at least one of the post-war systems, proved that a system should have a large amount of reserve capacity over that required for most normal driving conditions. An automobile installation is different from a stationary one because it cannot be left operating when the car is not in use or is unoccupied by passengers.

Large refrigeration capacity offers several advantages:

1. When a car has been parked in the sun, large quantities of heat are stored within, and refrigeration capacity must be sized sufficiently large to lower the temperature quickly. Many automobile trips are of short duration so quick cooling is necessary if the system is to have value.

2. There are times when the engine is idled or operated at very low speed over a considerable period. Therefore, it is important that the system have a reasonably good output during low speed operation.

3. Experience over the past year has demonstrated that owners will idle the motor of an air conditioned car much longer than one which is not air conditioned, and this has introduced additional problems in connection with the compressor drive and engine cooling.

4. Good general passenger compartment cooling can be obtained without resorting to high velocity air movement. By using slow velocity air throughout the car, local drafts, which cool some parts of the passenger's body more than others, can be avoided. The system which cools by local-

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ized drafts has been compared to that in an airplane, but generally most people would prefer the cooling as found in a modern railroad car.

5. Quietness of operation can be attained. One of the reasons for air conditioning in an automobile is the ability to drive with the windows closed, shutting out road noise and dust. It does not seem logical to merely substitute the noise of numerous high speed air jets in the car for the outside road noise and wind noise experienced when driving with windows open in cars which are not air conditioned.

Introduction of Outside Air

Most of the automobile air conditioning systems are now using from 15 to 25 percent outside air, and from 75 to 85 percent recirculated. This again calls for a higher capacity refrigeration system. The use of outside air has two advantages, (1) to get rid of smoke and odors which tend to accumulate in a car using recirculated air only and, (2) the introduction of outside air builds up a slight pressure in the passenger compartment which prevents the infiltration of dust and warm outside air through the numerous small leaks around doors, windows, etc. Experience has proved the use of 25 percent outside air to be successful.

Condensation

In one unit the flush louvered grille on the package shelf, through which the chilled air was delivered to the passenger compartment was changed to an outlet with louvers about 3 in. high to keep the cold air from striking the rear window and causing condensation or fog to form on the outside. This outlet also directs the cold air over the head of passengers sitting in the center of the rear seat and generally improves distribution through the car.

In those systems which employ roof distribution ducts, condensation will form on the ducts and outlet grilles when the doors are opened to discharge or take on passengers after the system is in operation. In time it may cause mildew and discoloration of the head lining material. This problem should be investigated.

Compressor Drive

Normally, people do not keep the engine running when they sit in a stationary car especially under warm weather conditions; however, with air conditioning they enjoy the comfort of keeping cool, and some trouble has been encountered as a result of lengthy operation of the cooling system with the engine idling. This practice results in high head pressure and high temperatures under the hood, both of which are unfavorable to the compressor belt drive. These conditions led to the adoption of steel core belts and later to a double-belt drive on two different makes of cars with which the author was associated. Due to design conditions, on a third model car the double-belt drive was used initially and it proved very satisfactory.

Engine Cooling

Air conditioning with the condenser located in front of the car radiator has added to the problem of cooling the engine, and again the longer periods of idling are one of the chief reasons. So-called heavy duty or export type radiators were used on some air conditioned cars, but while these radiators were better under heavy load medium and high speed running, they did not prove to be as good as standard radiators for the idling condition. Consequently, the standard low restriction domestic radiator is now extensively employed. A more efficient fan has been adopted which is driven at a slightly higher speed than the fans on cars which are not air conditioned.

Engine Idling

To alleviate the problems which arise from longer periods of idling the engine two solutions have been tried. First, an effort has been made to educate the drivers of air conditioned cars to speed up the engine during idling; and second, cars with air conditioning units have been equipped with a device which automatically increases the engine idle speed when the gear shift lever is in neutral with the air conditioner on. The higher idling speed will not only improve the compressor drive and engine cooling condition; it will also result in better cooling from the air conditioner.

Controls

The approach to the control problem has varied widely among the car manufacturers. Experience with heaters and similar devices has shown that the public will obtain the best results if the controls or adjustments are kept to an absolute minimum, especially those controls or adjustments which are accessible to the driver or the occupants of the car.

In the system with which the author has been associated there is only one control, namely the blower speed control, accessible to the occupants of the car. The two outside air dampers and the minimum temperature setting of the automatic temperature control valve are only accessible by opening the door to the trunk.

On the other hand, one make of car has 18 controls or adjustments accessible to the driver and the occupants for controlling air velocity, air distribution, temperature, admission of outside air and for starting and stopping the system. Theoretically, the large number of controls permits adjusting the system so that each passenger in the car can have conditions to his particular liking. Actually, in many cases the control available to one individual may effect air or temperature distribution to the discomfort of others.

It is believed that a well-engineered system with simple controls in the hands of the individual operator will give better general comfort with fewer problems and better appearance. Simple controls also offer an excellent opportunity for cost reduction.

Servicing the system

With all new devices on automobiles, there is a problem to get service parts in the hands of dealers and educate shop employees in servicing; automobile air conditioning systems have proved no exception. Many dealers have serviced the systems entirely in their own shops, while others have handled the mechanical work but called in refrigeration service companies to do the charging, testing and repairing of the refrigeration components.

The distribution of complete instruction books and service manuals

can be very helpful to dealers for shop use, and factory trained personnel can be sent on occasion to assist in service problems. As a whole, troubles experienced with automobile air conditioning equipment have not been excessive and the dealers have been quite successful in handling maintenance and repairs.

Future Developments

Compressor: One of the most pressing needs of the automobile industry is a small, lightweight, durable compressor which will stand up under high speed operation and at the same time perform well at low speeds. Due to the styling trend, space under the hood of an automobile for mounting and driving a compressor is becoming more and more difficult to find. A smaller unit is also desirable so it will not interfere with the servicing of spark plugs or other engine parts. Such a compressor would require low torque to drive and a small pulley, possibly eliminating the need for two belts. It would also interfere less with engine balance and the compressor should be less subject to vibration. The compressor should be capable of dependable operation up to a speed of 6000 rpm, and it should be about one-fourth to one-third the weight of present compressors.

Compressor Drive: Much study has been made on a variable-speed, quick-disconnect drive for the compressor. In addition, a variable speed drive would be very desirable for all of the engine driven accessories, namely: the water pump, fan, generator, pump for hydraulic steering, and the compressor. All of these units have an optimum speed that will meet the maximum performance requirement which is much lower than the maximum speed at which they are now driven. At the same time, it would be desirable to get better performance from these units at low engine speeds by driving them at higher speed. A variable speed accessory drive which would step up the speed of the accessory units at low engine speeds and then step down their speed at high engine speeds would not only give better performance from the accessories, but it would also considerably reduce the maximum horsepower required to drive them.

Condenser Cooling: As the sale of automobile air conditioning increases, the styling and design of the car will have to be modified to make better provision for cooling the condenser without interfering with engine cooling. Possibly, this will be accomplished by having a separate fan or blower instead of depending on the present engine fan.

General Simplification: It is expected in the future that many of the present air conditioning systems will be greatly simplified and the novelty of having something to show the customer will decrease. It is obviously inconsistent to spend money for a wrap-around rear window and then cover up the wrap-around part with plastic ducts which are never really transparent and which detract from the appearance of the car.

In future systems there will be fewer controls for the passenger of the car to operate. A properly air conditioned car should have uniform temperature control with a minimum of drafts. It can be annoying to some of the passengers when each one is free to change the air distribution, and this is particularly true with children in the car.

Packaged Air Conditioning: Several companies have under development a so-called packaged air conditioning system in which all of the air conditioning equipment is assembled into a single unit which is mounted in the trunk of the automobile.

Advantages Claimed for Package Systems:

1. The complete refrigeration system can be assembled and tested in a plant which specializes in air conditioning equipment, leaving only mechanical work to be performed in the automobile plant.
2. It lends itself to dealer installation and to transfer from an old car to a new one more readily than present systems.
3. Once the system is assembled and sealed it should be generally free of refrigeration type troubles.
4. It relieves the congestion in the engine compartment.
5. It will not interfere with engine cooling.
6. It is capable of giving maximum performance regardless of engine speed and consequently can be lower in capacity. This would be true only if the units are all electrically driven or driven by an auxiliary power plant.
7. The system can be completely inoperative when air conditioning is not required, and capacity and temperature can be controlled by varying the compressor speed, again depending on type of drive.

Disadvantages of Package System

1. It will take up more room in the trunk, and if a minimum of trunk space is to be used, it will have to be tailored to fit between the hump over the rear axle housing, the package shelf, the trunk lid hinges and the spare tire: so there will be little chance of being able to transfer the unit from one car to another, unless of the same model.
2. To cool the condenser and supply outside air for the evaporator will require a much larger outside air intake which involves a styling problem, as well as special openings in the body or trunk lid.
3. With the greater amount of machinery in the trunk, it will be much more difficult to seal off the noise from the passenger compartment.
4. If an electric drive is used, it calls for a much larger generator which may be either a-c or d-c and which must be driven from the engine, probably with special means for cooling. Along with the wiring and extra motors, this adds materially to cost. If an auxiliary gas engine is used, it presents a noise problem. If a hydraulic drive, the piping from pump to motors is bulky and the hydraulic system very costly. If a flexible cable drive from the engine is used, we run into most of the same problems that we have in the present compressor drive, plus additional problems of noise, whip and life of the flexible cables.
5. Experience with the package system up to the present time would indicate that it will cost more than the type of system now in use.

The past year has demonstrated convincingly that automobile air conditioning is now an important part of automobile manufacturing and sales, as indicated by public demand; and that the sale of many automobiles may depend on the dealers' ability to deliver the car with air conditioning.

Automobile manufacturers recognize its possibilities as a profitable accessory and as an aid to selling cars, so there is every reason to believe that in forthcoming cars, designers will make the necessary provisions for a good installation.

Whether the ultimate design will follow present practice or packaged systems, is difficult to determine now, but present indications point to lighter weight, less bulk, lower costs and simplification in the installation and operation of the system.

A low aerial view of Houston's business section (estimates at beginning of 1953 placed the population within the city's corporate limits at 665,000 and 924,000 within the metropolitan area)

Houston Calls Society Members

HOUSTON is the attraction for ASHVE members from January 25-27, 1954. Final details and plans for the 60th Annual Meeting are now complete, according to D. M. Mills, general chairman of the Committee on Arrangements.

Technical Sessions Offer Variety of Papers

The Program and Papers Committee, Prof. B. H. Spurlock, Jr., chairman, reports an excellent group of papers to be presented at four Technical Sessions.

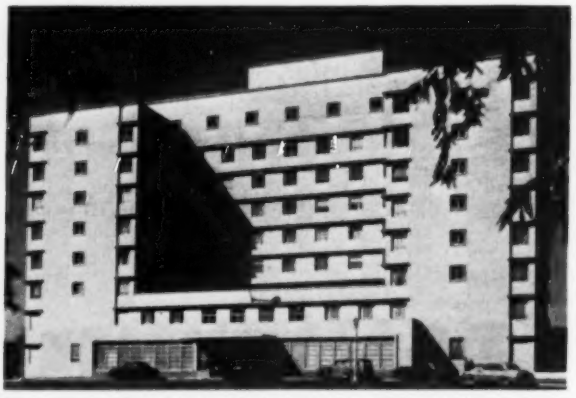
On Monday morning there will be three papers presented in which a method for predicting cooling tower performance; problems encountered and progress to date in automobile air conditioning; and pressure losses in air flowing through 45 deg wooden louvers will be discussed. L. T. Mart will be chairman at this session.

The Second Technical Session on Tuesday morning, with P. B. Gordon, chairman, will feature papers on circuit analysis for load estimating; heat flow characteristics of hot water floor panels; effects of non-uniformity and furnishings on panel heating performance; and field studies of floor panel control systems.

At the Third Technical Session, scheduled for Wednesday morning, at which Prof. B. H. Jennings will be chairman, there will be papers on cost of operating a major heat pump

Part of Houston's New Medical Center

The new Hermann Hospital in Texas Medical Center



The new 9-story Methodist Hospital in Texas Medical Center

PROGRAM — 60th ANNUAL MEETING

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
Rice Hotel, Houston, January 25-27, 1954

Sunday — January 24

10:00 a.m. REGISTRATION—Mezzanine Floor—Lounge
10:00 a.m. Council Meeting
10:00 a.m. Committee on Research
2:00 p.m. Motor tour through beautiful residential section of Houston
4:00 to 6:00 p.m. Rendezvous for coffee Texas style—Sam Houston Room
Hostesses: Mrs. Reg. F. Taylor. Assisted by: Mmes. E. G. Floeter, Jr., J. W. Holland, J. C. Lewis, F. M. Neil, O. G. Rivoire, A. B. Ullrich, Jr.
7:00 p.m. For your pleasure a group of tables have been reserved for Dinner, Floor Show and Dancing at the Shamrock Hotel. (Reservations required two weeks in advance. No set price—pay your own check)

Monday — January 25

9:00 a.m. REGISTRATION—Mezzanine Floor—Lounge
9:00 a.m. Hospitality Room—Sam Houston Room—Hosts, North Texas Chapter, Dallas
9:30 a.m. FIRST TECHNICAL SESSION—Ballroom
Call to Order—By Reg. F. Taylor, President
Greetings by D. M. Mills, General Chairman
Report to Officers and Council
Amendments to By-Laws
L. T. Mart, Chairman
Prediction of Cooling Tower Performance, by W. W. Smith
Automobile Air Conditioning—Progress and Problems, by P. J. Kent
Pressure Loss of Air Flowing Through 45-Degree Wooden Louvers, by P. R. Cobb
12:30 p.m. Welcome Luncheon—Ballroom—E. G. Floeter, Jr., president, South Texas Chapter presiding
Toastmaster: Morris Frank
Welcome to Houston: Mayor Roy Hofheinz
2:00 p.m. Chapters Conference Committee Meeting
2:30 p.m. Boat and bus trip to San Jacinto Monument—See Ship Channel, Industrial District; Visit Battle Ground and Battleship Texas
6:00 p.m. Dinner at San Jacinto Inn (served family style). Return to Rice Hotel by bus at 8:30 p.m.

Tuesday — January 26

9:00 a.m. REGISTRATION—Mezzanine Floor—Lounge
9:00 a.m. Hospitality Room—Hosts, Southwest Texas Chapter, San Antonio
9:30 a.m. SECOND TECHNICAL SESSION—Ballroom
Call to Order—L. N. Hunter, 1st Vice President
Report of Committee on Research—R. S. Dill, Chairman
P. B. Gordon—Chairman
Circuit Analysis Applied to Load Estimating, by H. B. Nottage and G. V. Parmelee
Heat Flow Characteristics of Hot Water Floor Panels, by E. L. Sartain and W. S. Harris
Effects of Non-Uniformity and Furnishings on Panel Heating Performance, by L. F. Schutrum and C. M. Humphreys
Field Studies of Floor Panel Control Systems, Part II, by A. B. Algren, E. F. Snyder, Jr., and R. R. Head
Report of Tellers of Election
12:30 p.m. Ladies Luncheon and Fashion Show—Empire Room
1:30 p.m. Nominating Committee Meeting
2:00 p.m. Inspection trips to Public, Industrial and Business Buildings
1. Hughes Tool Co. and Gulf Brewing Co.
2. Houston's new Medical Center showing several types of heating and air conditioning installations. Also new Prudential office building.
3. Sugarland Industries — Imperial Sugar Co. at Sugarland, Tex. See sugar refined from stalk to sugar sack.
4. Schlumberger Well Surveying Corp. (new and modern plant)
7:00 p.m. Dinner a la Mexicaine—Ballroom
7:00 p.m. Past Presidents' Dinner
8:00 p.m. Informal entertainment—Movies, TV shows—Cards (Mezzanine Floor)

Wednesday — January 27

9:00 a.m. REGISTRATION—Mezzanine Floor—Lounge
9:00 a.m. Hospitality Room—Sam Houston Room—Hosts, West Texas Chapter Lubbock, Tex.
9:30 a.m. THIRD TECHNICAL SESSION—Ballroom
Call to Order by John E. Haines, 2nd Vice President
Prof. B. H. Jennings, Chairman
Costs of Operating the Heat Pump in the Equitable Building, by J. D. Kroeker and R. C. Chewning
Availability and Utilization of Solar Energy, by R. C. Jordan and J. L. Threlkeld
Part 1. Solar Energy Availability for Heating in the United States
Part 2. Utilization of Solar Energy for House Heating
Part 3. Design and Economics of Solar Energy Heat Pump Systems
Effects of Air Conditioning on Plant Growth, by F. W. Went
1:30 p.m. Ladies Theater Party (Playhouse Theater) Buses leave Rice Hotel at 1:30 p.m. Curtain time 2:00 p.m.
2:00 p.m. FOURTH TECHNICAL SESSION—Ballroom
Call to Order—Reg. F. Taylor, President
W. A. Grant, Chairman
Room Air Distribution Research for Year 'Round Air Conditioning—Part II, Supply Outlets at Three Floor Locations, by H. E. Straub and S. F. Gilman
Cooling a Small Residence Using a Perimeter-Loop Duct System, by D. R. Bahnfleth, C. F. Chen and H. T. Gilkey
A Two-Sphere Radiometer, by D. J. Sutton and P. E. McNall, Jr.
Unfinished Business
New Business
Resolutions
7:00 p.m. Annual Banquet—Ballroom
Call to Order
Toastmaster: Dr. Baldwin M. Woods
Invocation
Presentation of F. Paul Anderson Medal to Walter L. Fleisher
Installation of Officers
Presentation of Past Presidents' Emblem to Reg. F. Taylor
Speaker: Dr. Walter W. Kemmerer, Executive Director of the Houston World's Fair
Subject: An Educator Looks at Air Conditioning
Dancing

Thursday — January 28

9:30 a.m. Organization Meeting of Council

installation; availability and utilization of solar energy covering solar energy for house heating, and heat pump design and operations, and an analysis of the effects of air conditioning on plant growth.

W. A. Grant will be chairman of the Wednesday afternoon session when the papers presented will cover: the results from a combination of earlier studies on room air distribution for year 'round air conditioning; the cooling of a small residence using a perimeter-loop duct system; and the design and operation of a two-sphere radiometer.

The Cathedral of Mexico City — This will be one of the many points of interest to be included on the post meeting Mexico trip for Society members

Entertainment Highlights

The entertainment program gets under way on Sunday afternoon with a rendezvous for coffee Texas Style in the Rice Hotel. Arrangements have been made for an evening of dining and dancing at the Shamrock Hotel on Sunday night.

At the welcome luncheon on Monday, in the ballroom of the Rice Hotel, E. G. Floeter, Jr. will preside and Morris Frank, of the *Houston Chronicle*, will be toastmaster.

Monday afternoon there will be a boat and bus trip to the San Jacinto Monument and Battleground. There will be an opportunity to see Houston's famous ship channel and industrial district as well as to take an elevator ride to the top of the monument (570 ft) and to visit the Battleship Texas. At 6:00 o'clock dinner will be served in family style at the San Jacinto Inn on the Battleground, followed by a get-together party at the Inn.

The ladies will enjoy a style show and luncheon on Tuesday at 12:30 p.m. That afternoon members may select any one of four interesting trips including the plants of Hughes Tool Co., and the Gulf Brewing Co.; the new Medical Center showing several types of heating and air conditioning installations, and the new Prudential office building; Sugarland Industries, Imperial Sugar Co. (see sugar refined from stalk to sugar sack); and the new and modern plant of the Schlumberger Well Surveying Corp.

An authentic Mexican dinner, delicately seasoned to everyone's taste, followed by informal entertainment, movies, and cards, is on the program for Tuesday night.

Wednesday afternoon the ladies will attend a theater party featuring a visit to Houston's famous theater-in-the-round at the Playhouse Theater.

The meeting will come to a formal close on Wednesday night with the 60th Annual Banquet, which will be highlighted with an address by Dr. W. W. Kemmerer, and the installation of Society Officers. Dr. Kemmerer is former president of the University of Houston and now is executive director of the Houston World's Fair.

Committees Plan Meetings

Among the committees scheduling meetings, besides the two meetings of the Council, are the Committee on Research, several Council Committees, the Chapters Conference Committee, and a number of the Technical Advisory Committees.

Post-Meeting Trip to Mexico

An all-expense trip to Mexico is offered to members, their wives and guests, following the 60th Annual Meeting. All arrangements will be handled by the U.S. Travel Agency.

The trip will begin in Houston, Thursday, January 28, at 3:00 p.m. with a Pan American Airways flight to Mexico City arriving three hours later. Among the highlights of the trip will be a two-day motor trip to Cuernavaca and Taxco; a one-day motor trip to Guadalupe Shrine and the famous pyramids; a motor trip through Mexico City; a trip to the floating gardens of Xochimolco and as an option, an additional three-day visit to world-famous Acapulco.

Included in the price of the trip are first class round-trip air transportation from Houston to Mexico City; rooms with twin beds and bath at the Del Prado or Bammer Hotels in Mexico City; all sightseeing charges; all transfers and baggage handling charges; and hotel accommodations and all meals while on trips outside of Mexico City.

The total time of the trip will be six days unless the optional visit to Acapulco is included.

Complete details of the trip, including costs, were contained in a colorful brochure mailed to members in November. Reservation forms for the Mexico trip and all inquiries concerning it should be addressed to: Ralph L. Preble, U.S. Travel Agency, 807-15th St., N.W., Washington 5, D.C.

It's only a month until the Houston Meeting. Members who have not yet completed their travel plans, or made their hotel or special events reservations are urged to do so at once. It's Houston in January 1954.

Honored by Life Membership

RANDOLPH H. CARPENTER — Manager, New York Office, Nash Engineering Co., South Norwalk, Conn.

Mr. Carpenter was born in East Providence, R. I., on July 14, 1888. He received his B. S. degree in electrical engineering from the University of Rhode Island. Following

R. H. Carpenter
New York, N. Y.

graduation he was employed by the Westinghouse Electric & Mfg. Co. in East Pittsburgh, Pa., and later in the sales engineering department of its New York office. During World War I he also taught night courses at Pratt Institute, Brooklyn.

Mr. Carpenter joined the Nash Engineering Co. in 1920 and was appointed manager of its New York office the following year.

During his 32 years as a member of ASHVE, he has served two terms on the Society's Council, from 1930 to 1935 inclusive, and has been an active member on various Society committees, presiding as chairman of the Committee on Chapter Relations, Finance Committee and the Committee on Constitution and By-Laws. He also served as a member of the Special Committee To Study Methods of Selecting Society Officers and Council Members in 1939 and 1941.

Mr. Carpenter served as general chairman of the Committee on Arrangements for the 52nd Annual Meeting, held in New York in January 1946, and was toastmaster at the 54th Annual banquet.

In addition to his activities with ASHVE, he is a member of the Chemists' Club of New York, the Sales Executives Club of New York and the Westchester County Grand Jurors' Association.

HERBERT S. MOORE — Factory Representative of Iron Fireman Mfg. Co., in Toronto, Canada. Following service overseas with the Canadian Field Artillery during World War I, Mr. Moore worked with H. H. Angus, Consulting Engineer, in pioneering the development of automatic

H. S. Moore
Toronto, Ont., Canada

heating with forced hot water circulating pumps in Canada.

Born June 19, 1888 in Stockton-on-Tees, England, Mr. Moore began his career with the Canada Foundry Co., later transferring to the Redcliff Iron Works, Alberta, until the outbreak of World War I. During the late twenties, he was vice president of the Atlas Engineering Co. He was appointed a member of the Government Advisory Committee for Canada's Fuel Conservation and Oil and Gas Conversion Program during World War II.

Affiliated with the Ontario Chapter of ASHVE since 1923, Mr. Moore served as vice-president and president in 1930-31 and contributed to the chapter's early success, as a member of its Board of Directors and on various committees.

Mr. Moore also holds Life Membership in *A.F. & A.M., Toronto Lodge of Perfection and Rose Croix;* the *Moore Consistory of Scottish Rite in Canada,* and the *Western Ontario Commercial Travelers' Club.*

CECIL W. FARRAR — Administrative Officer, Sales Promotion and Advertising, W. A. Case & Son Mfg. Co., Buffalo, N. Y. A member of ASHVE since 1918, Mr. Farrar helped to establish the Western New York Chapter in 1919 and subsequently served two terms as presi-

C. W. Farrar
Buffalo, N. Y.

dent of the chapter. He served as treasurer of the Society and as a member of the Council in 1930, and on many of the Society's Committees.

Mr. Farrar began his career with the American Radiator Co. in 1908 in the research department of its Pierce Radiator Plant and was later transferred to the sales department of the company. He resigned from American Radiator to join the U. S. Radiator Corp., Detroit, as advertising manager and assistant sales manager. In 1921 he became vice president of the Excelso Specialty Works, and from 1927 to 1939 was president of the Excelso Products Corp., a subsidiary of the American Radiator Co. He was also secretary of all general sales divisions of American-Standard.

He joined the W. A. Case & Son Mfg. Co. in 1939 as vice president in charge of sales promotion. During World War II he represented Eaton Metal Products Corp. in Washington, and in 1944 became vice president in charge of sales, the Richmond Radiator Co. He rejoined W. A. Case & Son Mfg. Co. in July of this year.

Honored by Life Membership

EDGAR N. BLACK, III, Philadephia, Pa.—Manager of the Fitzgibbons Boiler Co., Inc., and a member of ASHVE since 1921. Mr. Black was born in Philadelphia Feb. 23, 1888. He studied mechanical engineering at the University of Pennsylvania, graduating with a B. S. degree. His early training consisted in work as assistant engineer of construction for the University, and as construction engineer with a Philadelphia firm designing and supervising installations, heating and ventilating systems, power plants and refrigeration.

He was employed from 1916 to 1917 by the Harrison Safety Boiler Works, Philadelphia, as a test engineer and from 1917 to 1920 as assistant material engineer for the American International Shipbuilding Corp. Prior to his association with the Fitzgibbons Boiler Co., he was manager of engineering sales for the Walworth Mfg. Co. and manager of the Kewanee Boiler Co.'s Philadelphia office.

SAMUEL L. HAAS, Chicago, Ill.—President and treasurer of the Advance Heating & Air Conditioning Corp. Born May 17, 1888, in Chicago, Mr. Haas was educated in Chicago schools and studied engineering at Armour Tech. He was associated with the Western Valve Co., Chicago, from 1903 to 1912. In 1912 he became president and treasurer of the Advance Heating Co., now known as the Advance Heating & Air Conditioning Corp. Mr. Haas joined the Society in 1923.

HUDSON D. HENION, Toronto, Canada—Joined ASHVE in 1923 and was elected president of the Ontario Chapter in 1939-40. He is currently employed as sales consultant, on a part time basis, for the C. A. Dunham Co., having formerly been sales manager of the firm.

Educated at Geneva, N. Y., High School and Hobart College, Geneva,

Hudson D. Henion

his career was initiated when he became a heating and plumbing equipment jobber in Chicago. In 1920 he acquired the rights for the manufacture and sale of Young Centrifugal vacuum and boiler feed pumps in Canada. He joined the C. A. Dunham Co., as sales manager in 1925, after the purchase of the Young Pump Co. by the C. A. Dunham Co.

JAMES C. MATCHETT, Chicago, Ill.—President and treasurer of the Illinois Engineering Co. since 1950 until his recent retirement. He joined the company's engineering and sales department in 1912, subsequently serving as secretary and general manager and for 27 years as vice president.

After graduation from Armour Tech. in 1907 with a degree in mechanical engineering, he was employed for a year by the Alberger Condenser Co. and from 1908 to 1910, by the American Air Cleaning Co. In 1910 he joined the McCrum-Howell Co., leaving it in 1912 to

James C. Matchett

begin his long and successful association with Illinois Engineering Co.

Mr. Matchett has been a member of ASHVE since 1923. He is also a member of *ASME*.

JAMES H. MCCAULEY, Chicago, Ill.—A member of the Society since 1921, he is president of J. H. McCauley & Son, Chicago. Born Aug. 29, 1888, in Chicago, he also attended public schools in Chicago, and his early training began in 1907 as a draftsman for the Chicago Railways Co. In 1910 he was appointed a mechanical engineer with the Chicago Surface Lines and from 1915 to 1917 served as Building Inspector for the city of Chicago. He joined the Western Electric Co. in 1917 as a mechanical engineer; in 1920, the W. J. Gemeny Co., as an estimator, and subsequently entered into business for himself.

J. CLARENCE HOBBS, Painesville, Ohio—At present a scientific adviser, he was manager of the Allegheny County Steam Heating Co. when he joined the Society in 1920. In addition to serving as president of the Pittsburgh Chapter in 1923 and 1924, Mr. Hobbs has served on various Committees, including the Committee on Steam & Return Main Sizes, the Nominating Committee and the Committee on Pipe Sizes.

Mr. Hobbs received his B. S. degree in mechanical engineering from the Carnegie Institute of Technology, where he did special work in electrical and refrigerating engineering. The year following his graduation, he taught engineering measurements and laboratory testing at the Institute. From 1911 to 1920 he was assistant superintendent of power stations for the Duquesne Light Co., Pittsburgh, and in 1912 was put in charge of central heating and engineering for the company.

In addition to ASHVE, Mr. Hobbs is also active in *ASME*.

Summary of Chapter Meetings*

• *ARKANSAS:* The October meeting was called to order by Pres. Herman Cumnock at the Sam Peck Hotel.

Pres. Cumnock introduced the guest speaker for the evening, L. N. Hunter, first vice president of the Society, and vice president of research, The National Radiator Co., Johnstown, Pa. *Ratings of Automatic Fired Heating Boilers* was the main topic of Mr. Hunter's talk and following this interesting presentation there was a lively question and answer period.

Reports were presented on the membership drive and the Council budget, after which the meeting was adjourned. Attendance 24. Attendance ratio 0.34.

• *ATLANTA:* J. A. Marshall, program chairman, presented the program for the October meeting. This program consisted of a colored film, *The Natural Gas Story*, and was followed by a very interesting discussion. Leading this discussion were representatives from the Atlanta Gas Light Co.; Messrs. Bostick, Chushing, Dee and Sheahan. This panel answered questions about the film and also answered other questions on gas.

Pres. J. C. Croley called the October meeting to order and presented the minutes as read and approved. J. M. Lazenby was nominated and elected as a member on the Chapter's Conference Committee and T. A. Barrow as alternate member to represent the Chapter at the Annual Meeting.

Peter Van Dae, Jr., treasurer, reported on the finances of the Chapter after which the meeting was adjourned. Attendance 74. Attendance ratio 0.62.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

• *BALTIMORE:* Pres. H. D. Glaser called the October meeting to order at the Baltimore Engineer's Club. A summary of the Board of Governors Meeting, which was held in August, was given and it was urged that all members should try to be more active during the coming year.

Henry E. Voegeli, development engineer of the American Brass Co., spoke on *Economical Processing of Food and Comfort Conditioning With the Heat Pump.* He described how the heat pump had been successfully used in commercial installations and also emphasized the fact that through continuous experimentation, the heat pump is improving greatly. An informative discussion followed, after which the meeting was adjourned. Attendance 49. Attendance ratio 0.45.

• *CENTRAL OHIO:* The September meeting was called to order at the Sapphire Room at the Hotel Fort Hayes by Pres. N. T. Hess. The minutes of the previous meeting were read and approved, followed by a report by Treas. W. A. Schoonover.

The main event of the evening was a discussion on the *Past, Present, and Future of Heating and Ventilating.* Leading the discussion was a panel made up of Messrs. T. H. Bell, R. S. Curl, R. B. Engdahl, F. J. Lilly, Gene Schroeder, and T. R. Walker. The discussion was most interesting and was enjoyed by all.

The election of A. I. Brown to Life Membership in the Society was announced. This honor was bestowed upon Mr. Brown by the Central Ohio Chapter and also by the Society. Attendance 51. Attendance ratio 0.42.

• *CINCINNATI:* The October meeting was called to order by Pres. R. C. Beineke, at the Cincinnati Engineering Society. H. E. Sproull and A. W. Edwards were appointed by Pres. Beineke to consider one of the Cincinnati Chapter members for the award as *outstanding engineer.* The 60th Annual Meeting, scheduled to take place in Houston in January 1954, was discussed and J. J. Bechtol volunteered to handle all details regarding transportation. A. W. Edwards spoke further on the Houston Meeting and pointed out the advantages of attending this meeting.

Reg. F. Taylor, president of the Society, spoke on *Some Unusual Situations Encountered in Air Conditioning Design.* President Taylor's talk was of interest to all present and a hearty round of applause followed this enjoyable discussion. Attendance 70. Attendance ratio 0.63.

• *CINCINNATI:* The speaker at the Chapter's September meeting was Patrick Boisseau of Radio Station WKRC who gave a talk on his experiences as an American radio officer in the U. S. Embassy in Bangkok, Siam.

H. E. Sproull, Society treasurer in 1951, was presented a Life Membership Certificate in the Society by A. W. Edwards, member of Council. Mr. Edwards reviewed Mr. Sproull's activities in the Society and the Cincinnati Chapter; and Mr. Sproull gave a resume of the founding of the ASHVE and its progress.

W. H. Rieger, chairman of the program committee, announced that the October meeting would feature Pres. Reg. F. Taylor as guest speaker, while at the November meeting Charles Gruber, Cincinnati Smoke Inspector, would give a talk on Smoke Abatement.

Many members of the Miami Valley Chapter were among the guests at the meeting and J. M. Schweiger, president of that Chapter, invited the members to attend the Miami Valley Chapter's next meeting. Attendance 75. Attendance ratio 0.60.

• *CONNECTICUT:* Charles Mosley, of the Chase Brass Co., gave an informative and interesting talk on copper and also discussed the recent price changes in this valuable metal.

R. B. Sweet, program chairman, reported on plans for future programs, and announced that the next meeting would be held in Bridgeport. C. L. L'Hommedieu, treasurer, stated a balance of cash on hand of $193.91.

President Nieske informed all members that R. W. Briggs would be unable to continue his duties as chairman of the Membership Committee and Carl Wahnquist, Jr. would be the new chairman. Attendance 44.

• *EMPIRE STATE CAPITAL:* A special joint meeting with the Albany Chapter of the *Society for Professional Engineers*, was held in October, and the chapter was the guest of the Professional Engineers at this meeting. The speaker was Albert Giannini, Carrier Corp., New York, N. Y. *The Carrier Conduit Weathermaster System of Air-Conditioning* was the subject of Mr. Giannini's talk which was illustrated with slides.

A buffet luncheon followed and members and guests enjoyed a pleasant and interesting afternoon.

• *GOLDEN GATE:* C. M. Wilson, general sales manager, Anemostat Corporation of America, New York, N. Y., was the guest speaker at the Chapter's first meeting of the season. Mr. Wilson spoke on *High Velocity and High Pressure Air Distribution Systems*, citing their advantages and the savings involved.

The October meeting was called to order by Pres. J. E. Murray at the Engineers Club of San Franciso, and he announced that H. C. Murphy was unable to attend the meeting and that arrangements would be made to present his Life Membership Certificate at a later meeting. President Murray then announced the appointment of the program, membership, reception, attendance, technical, finance, legislature, publicity and Fog Dispenser committees. Eric Roberts announced that the November meeting was to be a joint meeting with the Sacramento Valley Chapter and urged that the members attend the meeting. Attendance 81.

• *ILLINOIS:* The October meeting program was highlighted by a discussion on *Central Cooling*. S. M. Miner, industrial sales engineer, Central District, York Corp., Chicago, spoke on *Induced Air Units;* while W. B. Cooper, American Radiator & Standard Sanitary Corp., Pittsburgh, spoke on *Fan Coil Filter Units.*

Mr. Miner discussed the physical characteristics of the high pressure induction unit ventilator system, and he pointed out that the ratio of induced air to primary air is fixed with a fixed induction nozzle. He discussed the main elements of the primary air supply system covering piping details and special considerations. He stated that it is possible with the induction unit to obtain dewpoint control on the primary air system which usually handles 100 percent outside air. The system involves a chilled water circuit for the primary air and a secondary water system which is usually 8 deg. above the primary water temperature for the recirculated air cooling. He stressed the fact that there is a great need for complete analysis of each job and that this type of unit should be used only where the analysis of all phases of the job indicates it to be the wisest selection.

In his discussion, Mr. Cooper pointed out that this type of unit offers a great deal of flexibility and is applicable to a wide range of jobs from the smallest to the largest. He further pointed out that all of the air, recirculated and outside, is filtered and that the units particularly lend themselves to individual room zoning and multiple occupancy spaces. These units also afford variable fan speed control.

• *INLAND EMPIRE:* Pres. G. M. Dieter called the September meeting to order, and H. A. Bickel, program committee chairman, announced that the meeting programs for the entire year had been arranged and that the schedule would appear in the membership roster. J. A. Doyle commended L. E. Marque, of the membership committee, for his outstanding work on that committee, and the attendance committee was also recognized for its fine work.

G. C. Murray introduced the speaker for the evening, Charles Anderson, boiler inspector, City of Spokane, who gave a very informative as well as humorous talk on *Interpretation of the ASME Boiler Code*. Mr. Anderson stressed the importance of taking out a permit on boiler installations or alterations before the work is begun. He expressed his willingness to cooperate with contractors and engineers in working out problems that involve the code. Mr. Anderson stated that too many times the work is completed before he is called in for advice, and this frequently results in costly changes that neither the owner nor the contractor are prepared to absorb. It was pointed out that the two most frequent violations in boiler installations or alterations are mounting heights of low water cut-offs and improper relief valve capacities. Attendance 16.

• *IOWA:* Pres. J. F. Sandfort called the October meeting to order at the Standard Club, and announced the appointment of the Membership and Legislative Committees as follows: Membership: J. R. Bain, chairman; W. G. Barnard, P. M. Boatman; Legislative: D. E. Wells, D. C. Murphy, C. H. Boatman.

After all business had been completed the members and guests went to the Meredith Publishing Co. plant, where Robert Spry, manager of engineering, gave a talk outlining the scope of Meredith's operations. Plant heating, production facilities, ventilating and air conditioning installation were described by Mr. Spry and later a conducted tour of the plant was enjoyed by all present. A very interesting and pleasant evening was had by everyone. Attendance 36.

• *KANSAS:* J. E. Haines, second vice president of the Society, was the guest speaker at the October meeting of the Kansas Chapter held at the Broadview Hotel and presided over by Pres. R. L. Pennington. Mr. Haines' subject of discussion was entitled, *The Next Ten Years.* A review of the growth in America of the heating and air conditioning industry; a review of the past ten years of the Society; predictions of things to come in the next ten years for the Society; were all part of Mr. Haines' discussion. This information was enlightening and of interest to all. Attendance 56. Attendance ratio 0.70

Mississippi Chapter Officers with Pres. Reg. F. Taylor presenting Charter to Burt Lomax, Jr., its first president. *(l. to r.)* Robert Porter and R. E. Vernon, Board of Governors; O. F. Rogers, vice president; Society President Taylor; Chapter President Lomax; J. W. Taylor, Board of Governors; and J. G. Coleman, secretary

• *KANSAS CITY:* F. K. Ladewig introduced the guest speaker of the evening, T. A. Welch of the Carrier Corp., Syracuse, N. Y. Mr. Welch's talk was entitled *The 24-Hour Method of Load Calculation* and this interesting discussion was illustrated by slides. A lively question and answer period followed.

W. A. Reichow presented J. E. Haines, second vice president of the Society and vice president of Minneapolis-Honeywell Regulator Co. Mr. Haines spoke on the plans and activities of the Society and his talk was well received.

Pres. G. H. Stoffer presented the minutes of the previous meeting which were approved as read. J. E. Miller, of the entertainment committee, was called upon to remind all members about the Fall party. With the completion of all business, the October meeting was adjourned. Attendance 109. Attendance ratio 0.31.

• *MANITOBA:* G. T. Christie presented the speaker for the evening, G. C. Davis, a chapter member. Mr. Davis' talk was entitled *The Manufacture and Uses of Light Weight Aggregates* and his discussion was interesting, as well as descriptive.

A. J. McIntyre announced a change in the meeting nights from the third Thursday of each month to the fourth Thursday.

The October meeting was held at the Fort Garry Hotel and presiding at this meeting was Pres. A. K. Piercy. Attendance 27. Attendance ratio 0.38

• *MINNESOTA: Propeller Fan Applications* was the subject of the talk given by J. P. Battie, chief engineer, Hunter Fan Co., Memphis, Tenn. Mr. Battie spoke on the progress made in this industry, and then explained how effectively a degree of cooling could be accomplished by replacing air within dwellings with cool night air.

During the business portion of the October meeting, J. S. Locke reported that only a small portion of members had paid their dues and requested the cooperation of the members in promptly responding. L. D. Freedland, chairman of the membership committee, reported that the Chapter had three new members, and C. T. Hastings reported on the status of the membership roster. J. E. Haines, second vice president of the Society, stated that the Minnesota Chapter had not yet submitted revised by-laws to the Society for approval by the Council and the Charter and By-Laws Committee. A motion was made to have a committee revise the Chapter's by-laws by the January 1954 meeting. Attendance 101.

• *NORTH JERSEY:* Pres. F. H. Faust called the first meeting of the season to order and proudly presented Society President, Reg. F. Taylor.

President Taylor gave a talk on current affairs of the Society, including its financial status, research program, new chapters, and the arrangements for the Annual Meeting to be held in Houston. His talk was well received and his visit highly appreciated by the North Jersey chapter.

P. B. Gordon, chairman of Technical Advisory Committee on *Panel Heating and Cooling*, was the technical speaker of the evening. Mr. Gordon has spent many years of research in connection with this subject and he described the work that has been done in recent years regarding panel heating and cooling. The interest of the membership was portrayed by the questioning period that followed this fascinating discussion. Attendance 87.

• *NORTH TEXAS CHAPTER:* A very interesting and informative talk was presented by G. W. Moore, vice president and general manager of Greater Dallas Planning Council. Mr. Moore spoke on *Dallas Stands At The Cross Roads* and brought before the members many of the problems that are involved in city planning. Mr. Moore's talk concluded with members remaining after the meeting to discuss further, the complex problems of city planning.

Pres. P. N. Vinther appointed a nominating committee consisting of

Messrs. R. E. Allison, chairman; H. M. Cunningham and H. J. Martyn, Jr.

The October meeting was called to order at the Melrose Hotel and President Vinther read the minutes of the previous meeting. Attendance 87. Attendance ratio 0.39.

• *NORTHEASTERN OKLAHOMA:* P. L. Weinman of the Armco Steel Corp. was the guest speaker at the Northeastern Oklahoma's September meeting. *New Developments in Special Purpose Steels for the Heating and Ventilating Industry* was the subject of a most entertaining and informative discussion. Mr. Weinman also obliged the chapter by answering many questions which concerned problems encountered by local members.

Pres. J. C. Netherton, Jr. called the meeting to order at the Student Activities Building of the University of Tulsa. The forthcoming Annual Meeting to be held in Houston in January was discussed and with the completion of all immediate business the meeting was adjourned. Attendance 14. Attendance ratio 0.28.

• *NORTHERN OHIO:* Pres. J. M. Black called the October meeting to order in the Allerton Hotel. Several committee reports were presented by the individual chairmen as follows: Membership, E. F. Morse; Program, H. R. Canoyer; Treasurer, W. F. D. Neiheiser; and Auditing, M. L. Erickson. President Black read a letter from Mrs. Cyril Tasker thanking the Chapter for the floral tribute sent at the time of Mr. Tasker's death. A few remarks were voiced concerning the Society's Council meeting held in Cleveland.

The Chapter was honored by having as its speaker Society Pres. Reg. F. Taylor, Houston, who presented a very valuable and informative talk on *Unusual Situations Encountered in Air Conditioning Design.* He commented upon the comfort chart and its relationship to geographical locations. His talk was supplemented with slides which were highly entertaining. Attendance 74.

• *NORTHERN PIEDMONT:* A nominating committee was appointed to prepare a slate of officers to be presented at the November meeting as follows: Messrs. C. C. Donovan, W. A. Graham, L. B. Hoffman, Arvin Page, and D. T. Waynick.

L. B. Hoffman, program chairman, introduced the speaker for the evening, L. M. Bouvier, consulting engineer of Reynolda, Inc., Reynolda, N. C. *Problems Encountered in Designing the New Wake Forest College* was the subject of Mr. Bouvier's talk and the type and selection of equipment being used for this project was especially stressed.

Pres. J. E. Hart presided at the October meeting which was held in the Reynolda Building. Attendance 34.

• *OKLAHOMA:* Pres. F. X. Loeffler opened the October meeting by introducing new officers, committee chairmen and new members. He also reminded the members of the 60th Annual Meeting of the Society to be held in Houston in January, 1954.

L. N. Hunter, first vice president of the Society and vice president in charge of research for the National Radiator Co., Johnstown, Pa., gave a very comprehensive and interesting history of the development of the various codes dealing with the rating of steam and cast iron heating boilers. The requirements of the several codes were discussed with an explanation of the test methods required of the boiler manufacturers to prove compliance with the several codes. Mr. Hunter prefaced his technical discussion with a brief review of the aims and purposes of the Society and the activities of the various committees and officers. His talk received a hearty round of applause and the Chapter felt very fortunate in having such a splendid speaker. Attendance 68. Attendance ratio 0.50.

• *ONTARIO: The Institute of Power Engineers* played host to the Ontario Chapter at the Royal York Hotel on the evening of October 19. This date was designated as ASHVE night and the members of the Chapter were nobly treated. The speaker of the evening was James Pryce, director of research, T. Eaton Co. Mr. Pryce spoke on *Engineering Recreation* and a lively discussion followed.

Vice Pres. M. C. Bailey presided in the absence of Pres. N. W. Kingsland. Vice President Bailey extended a hearty welcome to all members and guests and also announced that K. E. Gould would be chairman of the On-To-Houston Committee. Attendance 125.

• *PHILADELPHIA:* Pres. C. F. Dietz called the meeting to order at the Engineers Club. The minutes of the previous meeting were read and approved. Treas. C. J. Lubking was called upon to give the report on the treasury, after which M. E. Barnard reported on the proposed changes to By-Laws. These proposed changes are to conform with the Model By-Laws of the Society.

Lewis Smith of the C. A. Dunham Co. was the guest speaker of the evening and the subject of his talk was *Control of Steam Heating Systems.* The subject presented many interesting facts and Mr. Smith answered all questions that were raised. Attendance 110. Attendance ratio 0.28.

• *PITTSBURGH:* The first meeting of the season was a joint meeting with the *ASRE.* Pres. C. H. Schneider introduced the officers of the *ASRE* and the ASHVE to the members and guests.

President Schneider turned the meeting over to E. C. Hach, chairman of the program committee, who introduced the three speakers of the evening. The subject of discussion was entitled *Electric Service and Equipment Needs for Air Conditioning.* L. T. Kight, of Duquesne Light Co., was the first speaker and he discussed the service which his company could supply to meet the demands of Pittsburgh. He also spoke of the different kinds of current in the different areas and what some of the requirements of his light company demanded when putting in certain size motors, compressors, etc.

H. R. Jones, of West Penn Power Co., was the second speaker and his talk was along the same lines of Mr. Kight's. He discussed how West Penn Power Co. served the outlying districts and how their current is broken down on the same bases. He pointed out that their system is all overhead, whereas Duquesne is overhead and underground. C. J. Long talked on the requirements one needs before sizing up a job— circuit requirement, job requirement, operating conditions, and controls and protection from overloads, etc. This was one of the most interesting and informative meetings of the Pittsburgh Chapter and they enjoyed playing host to *ASRE*. Attendance 78.

• *SACRAMENTO VALLEY:* J. E. Marshall, program chairman, introduced C. M. Wilson, general sales manager of Anemostat Corp. of America. Mr. Wilson presented a very informative talk on *The Fundamentals of High Velocity Air Distribution*. He stressed the fact that high velocity duct systems must be designed with considerable care and attention must be given to decibel ratings. To offset the noise problem he illustrated the use of attenuating chambers located just ahead of the outlet diffuser. He also spoke at some length on the reduction of fan horsepower through proper duct sizing, a problem often the result at high velocity. To compensate for the careful design and use of expensive equipment, the speaker pointed out the advantages of smaller duct sizing, lower field labor costs and resulting overall smaller building space necessary to allow duct room. This was a very instructive talk and was enjoyed by all.

Pres. E. C. McKinsey awarded a past president's pin to L. A. O'Meara and commended him on the fine work accomplished while president of the Sacramento Valley Chapter. President McKinsey called the October meeting to order at the Coral Reef. Attendance 61.

• *ST. LOUIS:* C. F. Combs introduced the speaker of the evening, P. A. Argentiere of the Connor Engineering Co., who discussed *Design and Application of High Pressure Air Distribution Systems*. Mr. Argentiere stated that the advantage of a high pressure air distribution system is that it either results in a better job or makes possible a system which would otherwise be impossible. His talk was divided into two main parts; high pressure air distribution systems and diffusers and outlets. A lively discussion period followed this instructive and entertaining talk.

The October meeting was called to order by Pres. H. C. Sharp and he proceeded to read the May minutes as approved. K. J. Caplan brought to the attention of the Chapter the fact that ASHVE is one of the few engineering societies engaging in extensive research. Attendance 59.

• *SHREVEPORT:* Pres. M. A. Hudson called the meeting to order in the Colonial Room. A letter was read advising that a group in Baton Rouge have decided to form a local chapter in that vicinity. President Hudson concluded his comments by emphasizing the necessity for all members of the local chapter becoming members of the Society.

J. S. Malahy, Jr., program chairman, introduced the guest speaker for the evening, Don Cornell of the Standard Brass and Manufacturing Co. Mr. Cornell presented a very interesting talk on the all electric air-to-air heat pump. A lively question and answer period followed.

It was announced that the guest speaker for the month of October would be L. N. Hunter, first vice president of the Society and vice president, Research, The National Radiator Co., Johnstown, Pa. R. S. Segall, secretary, and H. E. Scott, treasurer, presented their reports after which the meeting was adjourned. Attendance 40. Attendance ratio 0.60.

• *SOUTH TEXAS:* The September meeting was opened by Membership Chairman J. B. Buckley who introduced all visitors and members.

Reports were presented by the chairmen of the membership, finance and code committees. An invitation from F. B. Frazee, Secretary of the Southwest Texas Chapter was extended to all members to attend the October meeting in Austin.

C. L. Fleming presented a brief explanation of the proposed Student Loan Fund to be developed by the various Texas Chapters as a memorial to the late Dr. F. E. Giesecke. This was approved by vote and Pres. E. G. Floeter, Jr. appointed C. L. Fleming to head a committee which will investigate means of obtaining financial backing for this fund.

W. L. Lashley, Jr., chairman of the program committee, took great pride in introducing Pres. Reg. F. Taylor who discussed *Development and Practice of Steam Heating*. President Taylor's talk was worthwhile and of great interest to everyone. Attendance 71. Attendance ratio 0.38.

• *SOUTHERN PIEDMONT:* Pres. R. E. Mason called the meeting to order at the Elk's Club and asked the Committee Chairmen to present their reports. R. S. Fullerton, of the By-Laws committee, presented his report and it was formally approved by the Chapter. Reports from J. A. Rice and C. N. Witmer, were heard. L. F. Lawrence, Jr., of the membership committee, introduced three new members and three prospective members.

R. S. Fullerton introduced the guest speaker, W. E. Hood from the Carrier Corp. *Residential Air Conditioning as It Stands Today* was the title of his discussion which was instructive and entertaining. Attendance 40.

• *SOUTHWEST TEXAS:* The October meeting of the Chapter was held at the Driskill Hotel in Austin. This was a social meeting to which the wives of members and guests were invited on the eve of the University of Texas-Rice football game.

The new officers were presented to the chapter and are as follows: President — L. H. Hornor; Vice President — F. B. Frazee; and Secretary-Treasurer — Boone Crisp.

A paper prepared by Reg. F. Taylor was read by D. M. Mills in which President Taylor reported on Society activities. Mr. Mills spoke briefly on the 60th Annual Meeting and requested that members and wives of the Southwest Texas Chapter take the responsibility for the Hospitality Room at the Rice Hotel on the 26th of January.

Werner Dornberger of the Mechanical Engineering Department of the University of Texas and J. T. King, former line coach of the University, were the guest speakers. Attendance 58. Attendance ratio 0.30.

• *VIRGINIA*: D. C. Delinger presented Reg. F. Taylor, Society President, as the guest speaker at the Virginia Chapter's October meeting. President Taylor spoke on *Some Unusual Situations Encountered in Air Conditioning Design* and described the gas engine air conditioning system in his residence. In addition President Taylor gave some pertinent information regarding the Society as to its financial standing, its growth, and the important part it plays in research and development. The evening proved to be one of interest and advantage to all.

Pres. E. D. Duval presided at this meeting and announced that the members of the nominating committee were unanimously elected as follows: C. G. Conaway, Jr., R. L. Burton, Jr. and M. H. Pelosi, Jr. Attendance 30. Attendance ratio 0.57.

• *WASHINGTON, D. C.*: Pres. J. G. Muirheid called the first meeting of the season to order at the Sheraton Park Hotel. President Muirheid presented a past president's pin to G. R. Walz who served as president during the 1952-53 year.

L. G. Humphrey, Jr., meeting committee chairman, introduced Society President, Reg. F. Taylor. President Taylor spoke about the research activities of the Society, the plans for research and as his main theme he spoke on *Some Unusual Situations Encountered in Air Conditioning Design*. He discussed the advantages and disadvantages of air conditioning in hospitals and he concluded his talk with an illustrated description of existing designs, and particularly the installation in his home of an air-to-air heat pump, powered by a natural gas engine. A most impressive talk was given by President Taylor and the lengthly discussion period that followed proved that this talk had been received with far more than ordinary interest. Attendance 66. Attendance ratio 0.47.

• *WESTERN NEW YORK*: The Western New York Chapter met on October 5 in the new plant addition to Buffalo Forge Co., Buffalo, N. Y. C. W. Stone introduced Reg. F. Taylor, Houston, Tex., president of ASHVE, who addressed the members and guests. In his talk President Taylor predicted a great increase in central home air conditioning, as well as in the sale of room units. He talked mainly on his experiences in the heating and air conditioning field, and especially that of the University of Houston. He also touched on the design temperatures and humidity conditions he uses in Houston. At the conclusion of his talk, President Taylor mentioned with reverence, the passing of three of the Society's past presidents, Dr. F. E. Giesecke, New Braunfels, Tex., L. A. Harding, Buffalo, and Prof. G. L. Larson, Madison, Wis.

President Taylor then presented a Life Membership certificate to C. W. Farrar, who helped establish the Western New York Chapter in 1919 and has served twice as its president.

The members were guests of Buffalo Forge Co. and after a trip through the plant, they enjoyed a social hour followed by dinner.

• *WISCONSIN*: The September meeting was called to order in the ESM Building by Pres. N. E. Hill. Treas. I. J. Rossiter was called upon to give his report on the chapter's financial status. A very favorable report was read, showing a balance of $1,020.68.

L. C. Plaehn introduced the guest speaker, H. W. Alyea, development and field engineer, The Johnson Service Co., Milwaukee, Wis. Mr. Alyea began his talk with a definition of a controller as a device that responds to changes in a variable and communicates the change to another device to bring about a correction of the change. Also discussed was the application of pressure regulators to variable volume air handling systems, and Mr. Alyea showed that by using the proper reference points for the pressure regulators you could obtain a more direct application to the problem. It was brought out that the proper choice of control points was most important in the final results obtained. He proceeded to show how regulation could be applied more directly in systems using a return air fan, in double duct systems, in unit ventilators and with varying boiler pressures. He advised the constant use of a discharge stat in such control systems. Mr. Alyea's talk was well received and the evening was one of enjoyment and interest.

STUDENT BRANCH

• *UNIVERSITY OF DETROIT*: The first meeting of the school year was called to order by Pres. J. R. Cairns who presented the proposed activities for the coming year. The faculty moderator, Prof. J. E. Lay, and the following officers: J. R. Cairns, president; N. L. Novak, vice president; W. E. Zimmerman, secretary; and J. C. Rumpf, recording secretary were present to receive and welcome all new members.

The guest speaker was J. B. Olivieri, chief mechanical engineer of the Victor Gruen Associated Architects and Engineers, Inc. Mr. Olivieri spoke on the aims and activities of the Society and urged the University of Detroit student members to have an active and working Student Branch. Appreciation and thanks were extended to the speaker, after which the meeting was adjourned.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 72 applications for membership, including 21 student applications and 9 reinstatements; in addition 18 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 31, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

Arizona

BLACKMORE, J. S., Owner, Blamo Sales Co., Tucson. REFERENCES: M. F. Blankin, L. N. Hunter, J. W. James, E. N. McDonnell.

COSGROVE, J. J., Appl. Engr., Minneapolis-Honeywell Regulator Co., Phoenix. REFERENCES: V. J. Carns, Robert Cleveland*, J. B. Hoaglund, C. T. Snider.

Arkansas

RULE, JACK, Repr., Mullins Engineering Co., Little Rock. REFERENCES: O. B. DeMaine, W. J. Franklin, C. P. Holder, J. E. Mullins.

California

BANCHERO, A. M., Sales Engr., Wesix Electric Heater Co., Sacramento. REFERENCES: J. C. Beckett*, S. W. Doolittle, Alvin Norberg*, R. A. Sarro.

BARRON, W. A. Sales Engr., E. C. Cooley Co., San Francisco. REFERENCES: E. C. Cooley, Jr., E. C. Cooley, Sr., D. E. McLeod, D. I. Murphy.

△DEANE, J. F., Vice Pres., International Sales Co., San Francisco. REFERENCES: R. C. Cushing, E. C. Fanning, Edward Hill, Jr., H. P. Sheldon.

HANDY, J. R., Estimator, Neil H. Peterson Co., San Francisco. REFERENCES: K. O. Alexander, H. V. Hickman, K. C. Mirov, N. H. Peterson.

KEMP, L. J., Indus. Svce. Supvsr., Southern California Gas Co., Los Angeles. REFERENCES: J. A. Gilbreath*, A. F. Michael, H. C. Pierce, L. B. Rayl.

POAGE, R. N., Engr., Pacific Metals Co., Ltd., San Francisco. REFERENCES: E. B. Green, W. G. Farwell, H. V. Hickman, E. C. McKinsey.

△ULOVEC, H. F., Vice Pres., Mehring & Hanson Co., Los Angeles. REFERENCES: L. B. Davenport, J. S. Earhart, J. L. McCullough, C. D. Walz.

Connecticut

WILSON, ARCHIE, Pres., Wilson Supply Co., New Britain. REFERENCES: E. R. Clement, Sr., P. J. Lamoureux, R. M. Ripley, Carl Wahnquist, Jr.

Georgia

BRYANT, H. R., Estimator, R. F. Knox Co., Atlanta. REFERENCES: T. A. Barrow, J. W. Borum, W. J. McKinney, J. J. O'Shea.

CENTORBE, J. K., Engr., Worthington Corp., Atlanta. REFERENCES: T. A. Barrow, W. M. Garrard, S. N. Roberts, Leo Sudderth, Jr.

GREESLING, E. L., Engr., R. F. Knox Co., Inc., Atlanta. REFERENCES: T. A. Barrow, J. W. Borum, W. J. McKinney, J. J. O'Shea.

PREWITT, W. E., JR., Branch Mgr., Wagner Electric Corp., Atlanta. REFERENCES: L. L. Barnes, L. C. Barton*, Frank Player*, N. J. Wilson.

Illinois

EMMETT, J. C., Asst. Tech. Engr., Vapor Heating Corp., Chicago. REFERENCES: E. H. Burgess*, N. O. Kirkby, A. Lemos, Jr.*, E. B. Moore.

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OBITUARIES

PETER FLEURY

Hamden, Conn.

The Society was saddened to learn of the death September 18 of Peter Fleury, sales engineer and Connecticut representative for the Thatcher Furnace Co., Garwood, N. J. Mr. Fleury was 70 years old. He was born and raised at Isle La Motte, Vt.

Long active in the sales of heating equipment, Mr. Fleury began his career in 1917 as a salesman with the American Radiator Co. In 1929 he was made manager of the company's Jamaica office and in 1935 was transferred to New Haven, Conn., as manager. He joined the Thatcher Furnace Co. in 1943.

The Society, of which Mr. Fleury has been a member since 1949, joins in extending sympathy to his widow and daughter, Katherine.

EUGENE J. LEFEBVRE

Westmount, Que., Canada

It was with deep regret that the Society learned of the recent death of Eugene J. Lefebvre, a member of ASHVE since 1937. An engineer with Warden King, Ltd., Montreal, he was 64 years old.

Mr. Lefebvre was born March 5, 1889 in Quebec. He was educated

in Quebec schools and was graduated from the Applied Science College in 1912 with a B. S. degree.

Prior to his association with Warden King, Ltd., he was employed for a short time by Francis Hyde & Co., Montreal. He was with Warden King, Ltd., from 1913 until his death.

WILLIAM K. SHINE
Minneapolis, Minn.

The death, following a brief illness, of William K. Shine of Minneapolis, Minn., has been reported to the Society. Mr. Shine was a representative of the Goodin Co., Minneapolis. He was 44 years old.

Born Aug. 2, 1909 in Minneapolis, Mr. Shine studied architecture at North Dakota State College from 1926 to 1930. During 1938 and 1939 he took an extension course at the University of Minnesota in heating and ventilating.

Mr. Shine was employed as a draftsman for the Grinnell Co., Minneapolis, from 1936 to 1940. He was appointed chief draftsman of the company in 1941. In July of 1946 he joined the Goodin Co. as manager of its heating department.

Mr. Shine had been a member of ASHVE since 1949.

EVERETT T. SIMONSON
Dayton, Ohio

Word has been received by the Society of the death last month of Everett T. Simonson, Dayton, Ohio. A partner of the Hughes-Simonson Engineering Co., Dayton, he had been a member of ASHVE since 1950.

Mr. Simonson, born June 23, 1912 in Springfield, Ill., was 41 years old at the time of his death. He was a graduate of the University of Illinois, having received his B. S. degree in mechanical engineering in 1935. Following a year with the Illinois Central Railroad as a machinist apprentice, Mr. Simonson joined the Airtemp Division of the Chrysler Corp. He was associated with the division from 1936 to 1946, advancing from application engineer and field engineer to manager of the division's Marine Department. During this time he helped to design the cold storage plant at Ft. Knox, Ky., and was in charge of design and installation of the conditioning and heating system of the Perfect Circle Corp., Richmond, Ind. The Hughes-Simonson Engineering Co., for consulting, sales and service in heating and ventilating equipment, was established in 1946.

EVAN E. STRATH
Dearborn, Mich.

The Society was saddened by the recent news of the death of Evan E. Strath in Detroit, Mich. Mr. Strath, 49 years old, was a design draftsman with the Ford Motor Co., Dearborn, at the time of his death.

Mr. Strath was born June 6, 1904 in Shoal Lake, Manitoba, Canada. He attended Shoal Lake public schools and was graduated from Shoal Lake Collegiate in 1920.

Mr. Strath joined ASHVE in 1950. His professional experience included designing, drafting and erection of paint spray booth systems, dust collection systems and ventilating systems for industrial uses for the Ford Motor Co. During World War II he did research on B-24 airplane cabin heating and wing de-icing systems.

WALTER YATES
Manchester, England

The news of the death of Walter Yates, July 11, at his home in Worsley, Manchester, England, has been received by the Society. Mr. Yates was chairman of the board and governing director of Matthews & Yates, Ltd., Swinton, Manchester. A member of ASHVE since 1901, he held a life membership at the time of his death.

Born Oct. 8, 1864, Mr. Yates was educated at the Manchester Technical School and the City Guilds of London Institute. He received his general engineering, heating and ventilating apprenticeship at Ashton & Lyne.

Mr. Yates was noted for the design of the Cyclone air propeller and blower, products manufactured by the firm of Matthews & Yates, which was established in 1883.

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PHILADELPHIA: M. E. Barnard-E. K. Wagner
PITTS.: C. H. Schneider-E. H. Riesmeyer, Jr.
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SOUTH TEXAS: J. W. Holland-W. N. Pauley
SO. CALIF.: J. S. Earhart-L. B. Davenport
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SO. W. TEX.: L. H. Hornor, Jr.-D. E. Locher
UTAH: M. L. Gollaher-Alfred Richeda
VIRGINIA: E. D. Duval-H. E. Marquart
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One Year: A. B. Algren, John Everetts, Jr., A. J. Hess, T. H. Smoot, W. N. Witheridge.

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*Member of Committee on Research.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(55 Chapters; 1 Special Branch; 9 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARIZONA:** 1953. Hdqrs., Phoenix, Ariz. PRESIDENT, V. J. Carns, 3602 No. 15th Dr. SECRETARY, A. J. Nelesen, Jr., 6744 No. 14th Pl.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, Herman Cumnock, 401 W. Capitol Ave. SECRETARY, W. J. Franklin, 619 Rector Bldg.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. G. Croley, 400 Batavia St., East Point, Ga. SECRETARY, T. A. Barrow, 157 Simpson St., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, H. D. Glaser, Federal Land Bank Bldg., 2315 St. Paul St. (18). SECRETARY, G. J. Senner, 6010 Edmondson Ave. (28).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets, Second Wednesday. PRESIDENT, C. W. Leek, 1155 West 49th Ave. SECRETARY, D. A. English, 6412 Adera St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, C. R. Acheson, 306 W. Genesee St. SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, N. T. Hess, 63 E. Goodale St. SECRETARY, R. A. Wilson, 20 S. Third St., (15).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, R. C. Beineke, 626 Broadway, (2). SECRETARY, A. H. Gerdsen, 224 E. Second St., (2).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, G. F. Nieske, 165 Maple St., Naugatuck. SECRETARY, E. J. Heagland, 257 S. Whitney St., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, H. L. Salaun, 317 Baronne St. SECRETARY, T. J. Jenny, 1000 S. Peters St., (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, Second Wednesday. PRESIDENT, N. W. Burrill, 33 Riverside Ave., Rensselaer. SECRETARY, L. V. Appleby, R.D. 2, Watervliet.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, J. E. Murray, 350 Mission St. (5). SECRETARY, D. E. McLeod, 3740 Clay St. (18).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, R. G. Chapin, 185 N. Wabash Ave., (1). SECRETARY, H. G. Gragg, Rm. 1310, 228 N. LaSalle St. (1).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, R. C. Blackman, 5505 N. Illinois St., (8). SECRETARY, J. W. Jackson, 3514 N. Drexel, (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, G. M. Dieter, 917 W. Mallon. SECRETARY, F. W. Jenkinson, N. 1904 Smith St., (15).

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, J. F. Sandfort, Iowa State College, Ames. SECRETARY, G. J. Kraai, 907 Sixth Ave. (14).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, R. L. Pennington, 520 So. Commerce (2). SECRETARY, O. B. Strahm, 601 So. Terrace Dr.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, G. H. Stoffer, 200 Riss Building (6). SECRETARY, A. S. Hurt, Jr., 2119 Washington St., (8).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Fourth Thursday. PRESIDENT, A. K. Piercy, 222 Osborne St. N. SECRETARY, D. B. Brace, 1550 Dublin Ave.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, A. L. Hare, 127 Federal St. (10). SECRETARY, W. G. Martin, Jr., 20 Winchester St. (16).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, A. W. Shelby, 972 Union Ave. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, John Schweiger, 593 Acorn Drive, Dayton (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, R. H. Oberschulte, 316 McKerchey Building, (1). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, V. E. Pearson, 739 Marquette Ave. (2). SECRETARY, E. T. Erickson, 500 Baker Arcade.

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, Burt Lomax, Jr., P. O. Box 1662. SECRETARY, J. G. Coleman, 2840 Arbor Hills Drive.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, B. J. Horsburgh, 940 Ogilvy Ave. (15). SECRETARY, R. J. Ker, 1000 Beaver Hall Hill, P. O. Box 340.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, O. J. Smith, 233 Grain Exchange Bldg., (2). SECRETARY, C. A. Failor, 5736 N. 33rd St. (11).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, J. E. Schechter, 32-08 38th Ave., Long Island City (1). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs. Cleveland, Ohio. Meets, Second Monday. PRESIDENT, J. M. Black, 1296 Gordon Rd., Lyndhurst. SECRETARY, M. L. Erickson, 7218 Euclid Ave., (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. Meets, Second or Third Friday. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 2307 Fairfield Ave.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, F. X. Loeffler, Jr., Box 529. SECRETARY, G. E. Ervin, 2520 N. W. 23rd St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, N. W. Kingsland, 31 Willcocks St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, A. N. Hoss, 621 S.W. Alder (5). SECRETARY, J. E. Finkbeiner, 10260 S.W. Daphne Pl. (1).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. Meets, Third Tuesday. PRESIDENT, G. L. Ostiguy, 282 Westhill Ave. (3). SECRETARY, N. J. Howes, Box 264, R. R. 1.

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, H. T. Orebaugh, 1330 Dearborn. SECRETARY, L. F. Christofferson, 7358-58th Ave. N.E., (5).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, C. F. Dietz, 3449 W. Indiana Ave. (32). SECRETARY, P. H. Yeomans, Architects Building (3).

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, C. H. Schneider, 310 Washington Rd. SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, H. L. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, First Wednesday. PRESIDENT, E. C. McKinsey, 4220 Annette (21). SECRETARY, R. A. Sarro, 5412 Argo Way.

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, H. C. Sharp, 4060 W. Pine Blvd. (8). SECRETARY, W. P. Norris, 1118 Fullerton Bldg.

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, M. A. Hudson, 753 Gladstone Blvd. SECRETARY, R. S. Segall, 603 Cotton St.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, E. G. Floeter, Jr., P.O. Box 6006 (6). SECRETARY, F. M. Neil, 3513 W. Dallas Ave. (19).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, L. B. Davenport, 137 S. Anderson St. (33). SECRETARY, J. L. McCullough, 1978 S. Los Angeles St. (11).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. E. Mason, 1726 Hutchinson Ave. (1). SECRETARY, S. B. Blanton, Box 6096.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, M. L. Gollaher, 1163 Roosevelt Ave. (5). SECRETARY, G. L. Soderborg, Sr., 42 E. 8th St. S.

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● **WASHINGTON, D. C.** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, J. G. Muirheid, Bureau of Ships, Navy Dept. (25). SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N. W. (6)

● **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. PRESIDENT, R. A. Mixon, 227 Whiteside Bldg. SECRETARY, R. B. Carow, 3721 31st St.

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, J. T. Anderson Michigan State College, East Lansing. SECRETARY, N. A. Buckley, 514 Park Rd., Jackson.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, C. W. Stone, 1219 Main St. (9). SECRETARY, C. W. Kaupp, 271 Delaware Ave.

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, N. E. Hill, 122 N. Hartwell Ave., Waukesha. SECRETARY, K. H. Forfar, 2711 N. 27th St. (10).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr, 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. Address mail to: Prof. R. R. Irwin, Dept. of M. E., Oklahoma A. & M. College.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletsel, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, C. E. Beavers, Box 4083. SECRETARY, C. R. Blank, Jr., Box 2021.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, J. R. Cairns, 4001 Florence, (21). SECRETARY, W. E. Zimmerman, 15359 Lauder (27).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.

Robert Shaw Dormitory

MICHIGAN STATE COLLEGE

EAST LANSING, MICHIGAN

ARCHITECT: Ralph R. Calder*
ENGINEERS: Snyder & McLean*
GENERAL CONTRACTOR
Christman Company†
MECHANICAL CONTRACTORS
Hickey, Shaw & Winkler*
*Detroit †Lansing

POWERS
TEMPERATURE CONTROL

Selected For The Heating And Ventilating System *And* **180** *Individual Shower Baths*

No compromise with safety or comfort in showers here.

After thorough tests and comparison with other shower regulators, Powers thermostatic water mixers were installed in Shaw Dormitory. Here are some of the reasons why:

1. In a shower regulated by a Powers mixer – there's no danger of scalding nor slipping and falling while trying to dodge a "shot" of hot or cold water due to **pressure** or **temperature** changes in water supply lines.

2. Failure of cold water supply to a Powers mixer instantly and **completely** shuts off the shower delivery.

3. A sudden 100° F. rise in hot water supply is barely noticeable in a shower regulated by a Powers mixer. Being thermostatic it protects bathers from scalding caused by "dead ends" in hot water supply lines.

4. Temperature of shower is **thermostatically** limited to 115° F.

Why risk shower accidents, unfavorable publicity and time consuming law suits? It's more economical to install Powers thermostatic mixers . . . They cost more. Their safety features make them worth more!

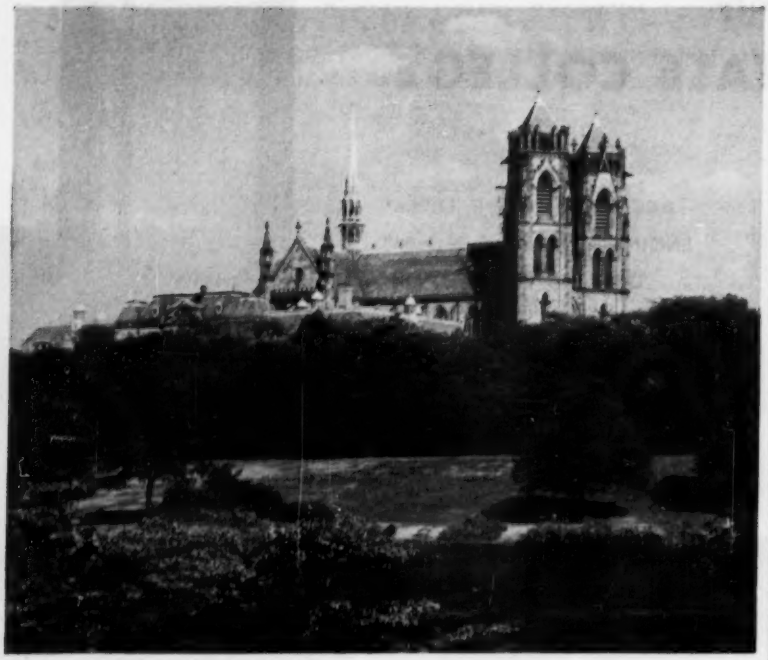
Don McAuliffe, football star on Michigan State's 1952 National Collegiate Champions, enjoying one of the 180 Powers regulated showers in the Shaw Dormitory.

POWERS THERMOSTATIC WATER MIXER complies fully with Veterans Hospital safety requirements in Federal Specifications WW-P541a.

THE POWERS REGULATOR COMPANY
SKOKIE, ILLINOIS
OFFICES IN OVER 50 CITIES IN U.S.A., CANADA, AND MEXICO • SEE YOUR PHONE BOOK

(b43)

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL



Paul C. Reilly, Architect Sears & Kopf, Consult. Engrs. Frank A. McBride Co., Heating Contractors

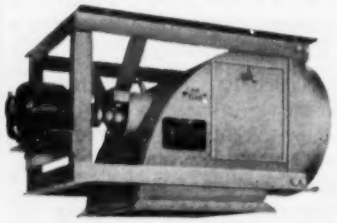
Newark's Cathedral of the Sacred Heart

One of the World's Great Cathedrals is equipped with WING DRAFT INDUCERS

Now moving to completion after fifty years of building, this magnificent edifice combines the architectural splendor of the past with today's utilitarian advancements. An example is the up-to-the-minute equipment that comfortably heats the spacious interior.

Handling a total load of 70,000 sq. ft. EDR are three H. B. Smith gas fired boilers. Even though a chimney was provided, consulting engineers decided that proper draft and removal of waste gases required a WING Draft Inducer for each boiler. Barometric dampers with relief gates were mounted integrally on each Draft Inducer.

The positive, dependable draft, in just the right volume, created by WING Draft Inducers assures efficient combustion at all times despite weather conditions, and without the need for tall stacks. Write for a copy of Bulletin I-52.



Wing

L. J. Wing Mfg. Co.

140 Vreeland Mills Road
Linden, New Jersey

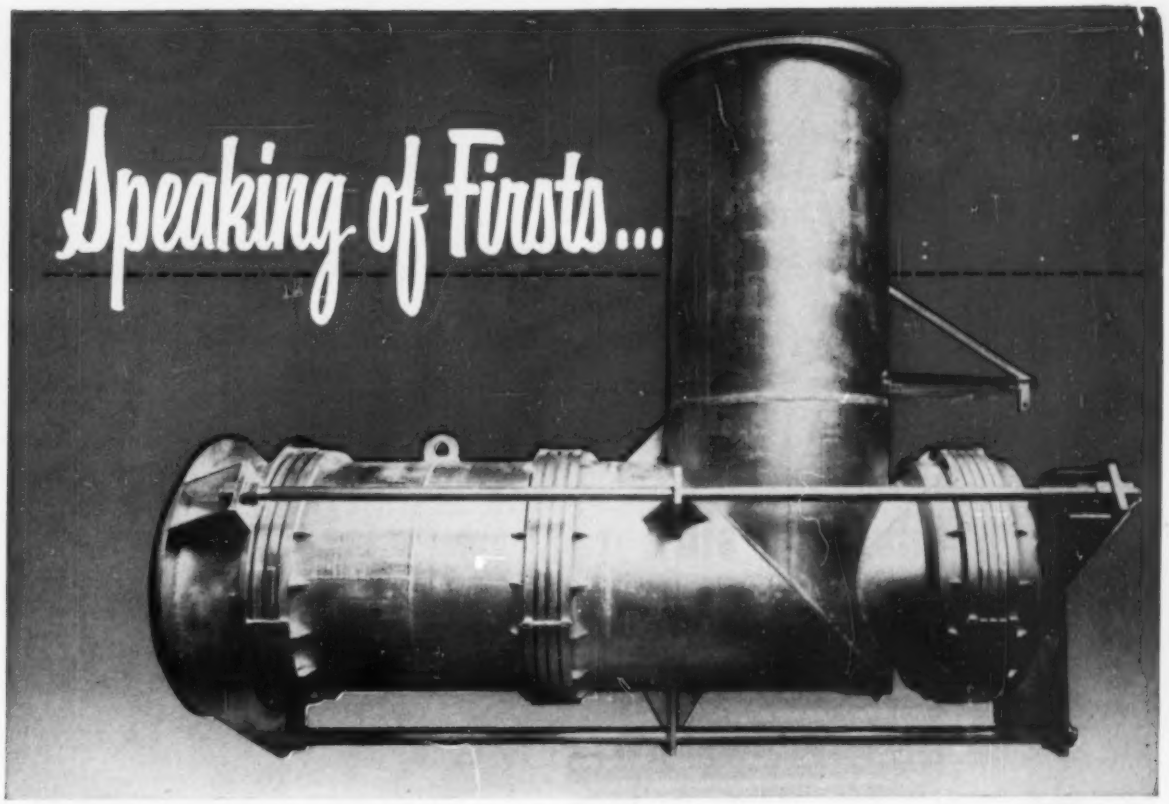
Factories at Linden, N. J. and Montreal, Canada

HEAT THAT MOVES AROUND

with the WING REVOLVING HEATER

The fact that the discharge outlets of Wing Revolving Heaters keep the heated air in gentle, constant motion is the reason firms like the Budd Company have installed Wing Revolving Heaters in their plants, both at Philadelphia, and at the plant shown in the photograph above at Gary, Indiana. Big blanking and forming presses make a natural barrier to ordinary heating systems, but

not to the moving streams of heated air from the Wing Revolving Heaters, even suspended, as they must be, far above the floor to clear the cranes. Uniform distribution is accomplished because the moving streams of heated air sweep slowly around through 360 degrees, covering successively every direction; thus every part of the plant is kept at a comfortable temperature. And in Summer, with the steam turned off and fans on, the revolving discharge outlets create a sensation of pleasing coolness that is very refreshing even on the hottest days. Write for a copy of Bulletin HR-6 to L. J. Wing Mfg. Co., 140 Vreeland Mills Road, Linden, New Jersey.



Recently, Zallea was given the assignment of developing a group of 48-inch expansion joints for flight propulsion test facilities on a classified defense project. The rigid technical specifications of this advanced application required "tailor-made" units for the job, so Zallea engineers analyzed the problem and designed the unusual-looking joint pictured above . . . the first of its kind. Actually, it is a Balanced Pressure, Universal Self-equalizing expansion joint, originally developed by Zallea engineers in 1945, operating at 165 psi and incorporating internal stainless steel turning vanes to provide a smooth flow of gases through the right angle bend. The unit absorbs 3" axial and 1.27" lateral movements through a temperature range from −100° F. to +650° F. No anchors are required since this arrangement neutralizes end thrust developed by internal pressures.

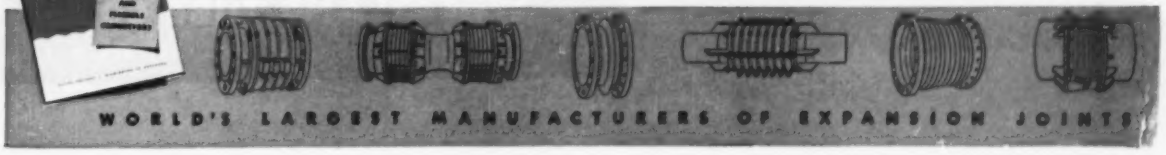
This example is representative of our ability to cope with the most difficult expansion joint problems. It is our business to specialize in the design and manufacture of one product only—expansion joints—and over the years we have learned how to solve the "tough ones" effectively and quickly.

Zallea Expansion Joints are available in diameters from 3 inches to 30 feet . . . for temperatures from sub-zero to 1600° F. . . . for pressures from vacuum to 300 psi in standard designs, and up to 2,000 psi in special designs.

The next time you are faced with an expansion problem, get in touch with us. We will be glad to survey your situation and recommend the most practical and economical solution. Zallea Brothers, 816 Locust Street, Wilmington 99, Delaware.

For detailed information on Zallea Expansion Joints and services write today for a free copy of Bulletin 351.

Zallea
EXPANSION JOINTS

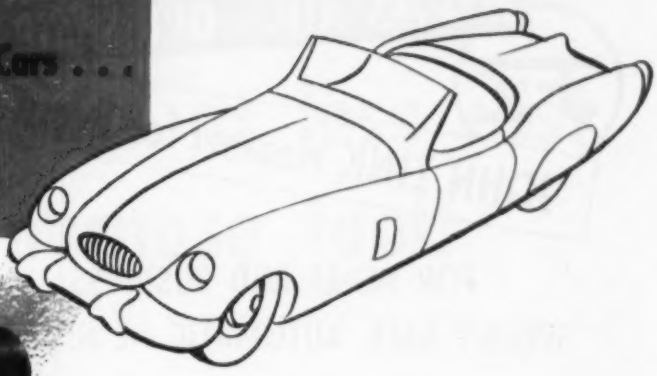


Best wishes for a full length
of health, happiness and prosperity--
through 1954.

WHEATLAND TUBE CO.

BANKERS SECURITIES BUILDING PHILADELPHIA 7, PA.

As Modern as Today's Sports Cars . . .
. . . and just as efficient



INSTANTANEOUS WATER HEATERS.
No tank required. 23 sizes; capacities to 300 gpm.; uses live or exhaust steam.

CONVERTERS.
26 sizes for economical heat transfer.

TANK HEATING UNITS.
20 sizes for all requirements.

STORAGE TANKS.
10 sizes; capacities to 315 gals.

FUEL OIL HEATERS.
17 sizes; capacities to 375 gph. at 2 lbs. pressure.

INDIRECT HEATERS.
15 sizes for use with large-size storage tanks.

This specialized line of Industrial Fluid Heaters

Precisely engineered for maximum efficiency, this modern line of GENERAL Fluid Heating Specialties meets a wide variety of industrial applications. Whether you are planning a completely new installation, or the expansion or modernizing of an old one — you'll find a GENERAL unit that will give you efficient, extra long service at low cost. Detailed information is available in Catalog 60. Write for your copy. General Fittings Co., Dept. A, 123 Georgia Ave., Providence 5, R. I.

WARMS AIR — DRIES AIR

J-Z JOHN ZINK

JOHN ZINK Heaters for Every Use

FOR HOME AND BUSINESS

SPECIFY SAFE, AUTOMATIC J-Z HEATERS

There are four styles of J-Z Heaters to meet every domestic and industrial heating requirement. J-Z Heaters provide many advanced engineering features that assure safe, economical operation and maximum heat output. Whether bought for home or commercial use, J-Z Heaters and Burners are AGA approved for natural, mixed or LP Gas.

FLOOR FURNACES

J-Z Gas Fired FLOOR FURNACES are available in five conventional and short models with input ratings from 30,000 B.T.U./hr. They become a complete one-package heating unit when equipped with safety pilot and automatic temperature control. Small grille, high heat transfer.

SUSPENDED UNIT HEATERS

Series UHS Fan Type UNIT HEATERS are fully automatic and provide clean, safe and trouble free forced air heating. Heaters are for all gases and are equipped with positive automatic safety shut-off valves. Have B.T.U./hr. rating from 55,000.

CENTRAL GAS HEATERS

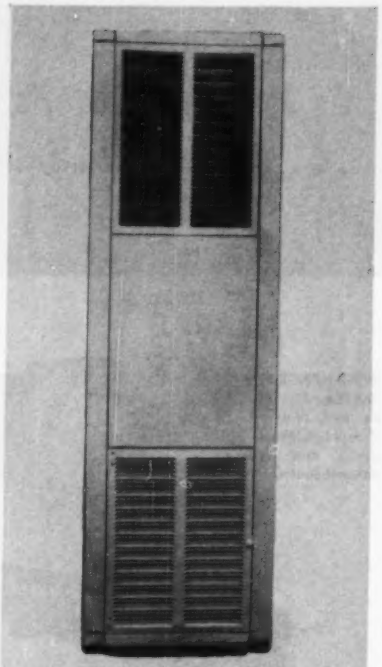
J-Z CENTRAL HEATING UNITS are compactly built, simple, efficient in operation and are available in Vertical or Horizontal type forced air models. Heaters can be installed in the basement, attic, service closet or utility room. The AF-110 may even be installed under the house if provisions are made for the draft diverter. For industrial applications, J-Z Central Heating Units can be installed on a shelf or balcony, as a suspended heater or as a duct heater. B.T.U./hr. ratings from 65,000.

WALL HEATERS

WH-25 Recessed Wall Heater fits between partitions on 16" stud centers. Barely 58" high. Available in standard or radiant styles. 25,000 B.T.U./hr. rating.

JOHN ZINK COMPANY

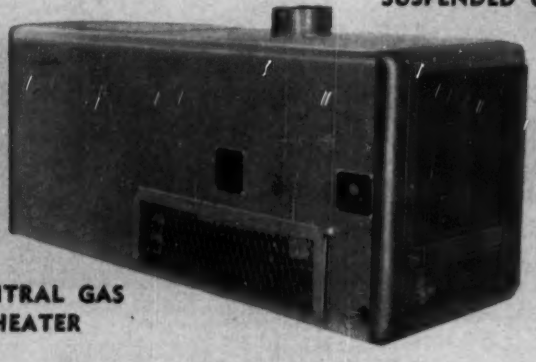
4401 SOUTH PEORIA • TULSA, OKLAHOMA



WALL HEATER

SUSPENDED UNIT HEATER

FLOOR FURNACE



CENTRAL GAS HEATER

Combination SKIL Drill and bench stand yours at less cost than one-purpose tool!

You can have a double-purpose SKIL Drill for less than the cost of a one-purpose drill press. With a SKIL Bench Stand you quickly convert your SKIL Portable Drill into a stationary drill press for production work—for greater accuracy in drilling small parts—for hole saw work. Rack and pinion gearing, heavy base and precision-ground column of SKIL Bench Stand give drill press accuracy—yet SKIL Drill is immediately removable for portable use in any location.

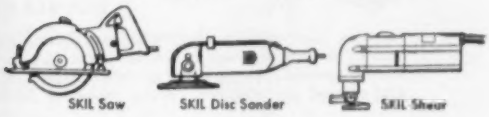
SKIL ½" Drill—Model 80 (at left)—Most widely used SKIL Drill of ½" capacity. Compact, streamlined design. Extra power. Ideal for drilling in metal, concrete, wood.

26 SKIL Drill models have these features

Modern, Compact Design • Helical Gears • Die-Cast Aluminum Housings • Oversize Brushes • Reserve Power • Statically and Dynamically Balanced Motors. Optional speeds available on many models.

Capacities: ¼" to 1" in steel; 2" in hardwood

Speeds: 200 r.p.m. to 5000 r.p.m.



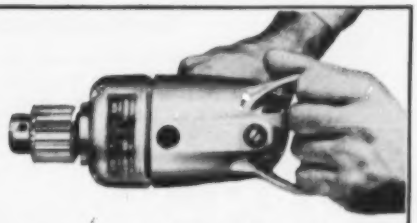
SKIL Saw SKIL Disc Sander SKIL Shear

SKIL
PORTABLE TOOLS

Made only by SKIL Corporation
formerly SKILSAW, Inc.
5033 Elston Avenue, Chicago 30, Illinois
3601 Dundas Street West, Toronto 9, Ontario
Factory Branches in All Leading Cities

Helical-cut gearing, ball and needle roller bearing construction insure uniform performance, quieter operation and longer life.

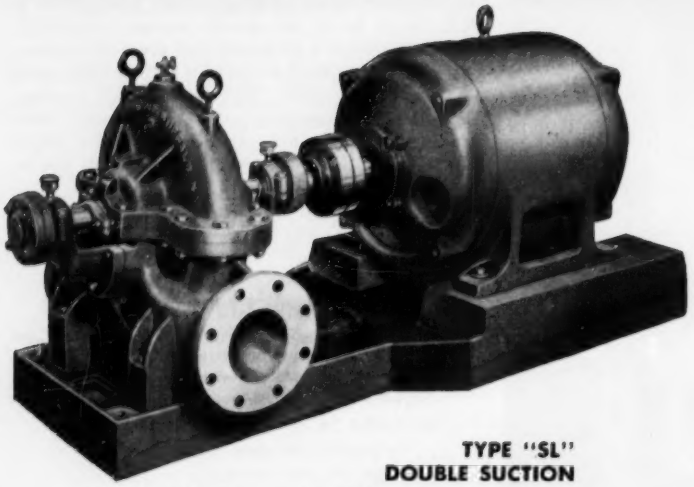
Only 3½" wide, the Model 80 SKIL Drill is easy to use in any position. Designed for use in tight places.



With an overall length of only 11½", the Model 80 SKIL Drill is more compact, has lighter weight, handles far more easily than other drills of comparable power and capacity.

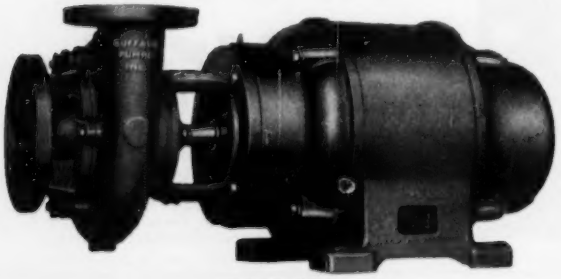
CONTACT YOUR SKIL DISTRIBUTOR—OR YOUR NEARBY SKIL FACTORY BRANCH—FOR COMPLETE INFORMATION

SATISFACTION
COMES FROM CAREFUL BUYING



TYPE "SL"
DOUBLE SUCTION

Here is high-volume, high-efficiency pumping of clear water, in capacities up to 14,000 gpm. One of the most widely specified pumps for air conditioning, air washing and related applications. Write today for Bulletin 955-P.



CLOSE-COUPLED

For maximum capacity in minimum space, these compact, husky "Buffalo" Pumps are available for clear water or a variety of chemical liquids. Write today for Bulletin 975-B. There's a "Buffalo" Pump for best results with your liquid, under your conditions.

. . . that's why generations of careful buyers have been picking

"Buffalo" PUMPS

The buyer of pumps today is faced with a bewildering choice of kinds and types. However, the experienced buyer can narrow his choice down to the right pump by considering these facts: (1) operating and maintenance costs are more important than first cost; (2) installed performance must be as good or better than on paper, or your pump investment will be wasted; (3) there must be a complete enough selection in the line to give you exactly the type and size you need.

Since the days of the steam pump, "Buffalo" has been fulfilling these conditions, building pumps for performance and economy on the job, rather than building them down to a price. And this, to the careful buyer, has always meant long-run satisfaction. So, before making your next pump purchase, it will pay you to check with "Buffalo" on the pump you can install and just about forget.

BUFFALO "Buffalo" PUMPS, INC.

171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

an ACCO product

Here is a NEW All-Purpose Gate Valve that is Easy to Sell

• Used for hot and cold water lines or low pressure steam—in plumbing, heating, and air-conditioning systems—in homes, apartments, restaurants, offices, stores, hospitals, industrial plants.

The strong, amply-sectioned body will not distort nor will seat warp under soldering temperatures. The R-P&C Bronze Solder End Gate Valve has full, unobstructed flow. For use with K, L, and M copper tubing. Working pressures: steam—125 lbs.; cold water, oil or gas (non-shock)—200 lbs.

Here is a stock item that has rapid turnover because of its general usefulness. Write today to nearest R-P&C district office listed below for information and prices.

No. 90 R-P&C Bronze Solder End Gate Valve

R-P&C valves

ACCO

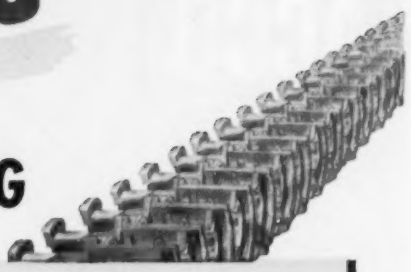
TRADE MARK

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

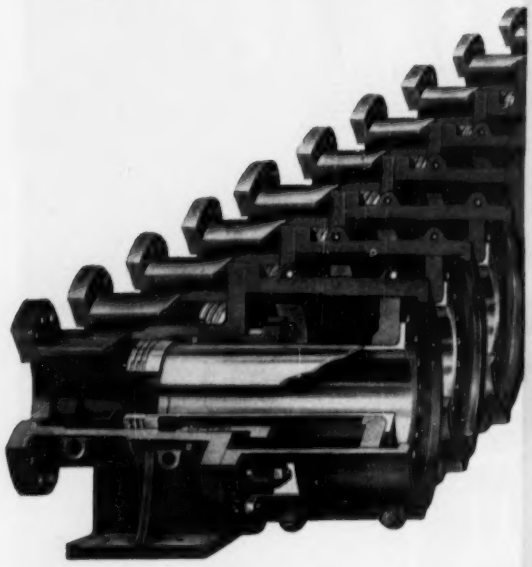
Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

6500 JOINTS

CAN'T BE WRONG



● You're sure to find the right one at **ADSCO**



No matter what expansion joint you need, look first among ADSCO's 6500 standard slip models. Manufacturing the world's most complete line of expansion joints, ADSCO is able to make a thorough analysis of your pipe expansion problems and to offer an impartial recommendation on the type of joint to use. Even if your problem is a unique one, remember that ADSCO has specialized since 1877 and can readily engineer a special joint to fit your needs.

King of ADSCO slip joints is the Piston-Ring, shown here. This exceptionally well-engineered and well-built joint carries the mark of ADSCO quality. Piston-ring feature permits it to be unpacked and repacked while maintaining full line pressure; thus service is not interrupted. Limit stops prevent over-travel of slip. Polished surface of slip cannot be scored because it is in contact with packing only. True alignment is assured by both internal and external guiding; split external guide permits smaller manholes. Full range of sizes, with 4", 8" and 12" traverse per slip, for pressures to 400 psi and greater and for temperatures to 800F and higher. Call an ADSCO representative or write for Bulletin 35-15H.

Use ADSCO Alignment Guides With ADSCO Expansion Joints

Don't let pipes get out of line. Use ADSCO Alignment Guides. Cylinder is 12" long in all sizes, permitting pipe movement of 10". Damage to insulation prevented by ample clearance between guiding cylinder and pipe.

ADSCO ENGINEERED PRODUCTS

EXPANSION JOINTS
HEAT EXCHANGERS
STEAM TRAPS
STRAINERS
SEPARATORS
METERS

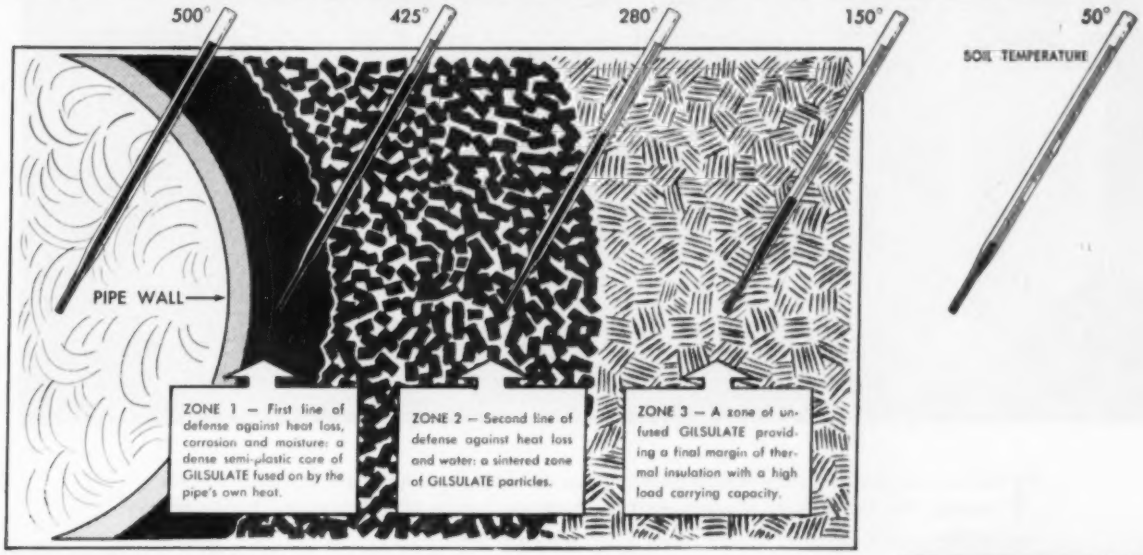
AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

Lowest Cost

PER INSTALLED LINEAR FOOT OF ANY HOT UNDERGROUND PIPE INSULATION


500°
425°
280°
150°
50°
SOIL TEMPERATURE
PIPE WALL
ZONE 1 — First line of defense against heat loss, corrosion and moisture: a dense semi-plastic core of GILSULATE fused on by the pipe's own heat.
ZONE 2 — Second line of defense against heat loss and water: a sintered zone of GILSULATE particles.
ZONE 3 — A zone of unfused GILSULATE providing a final margin of thermal insulation with a high load carrying capacity.

GILSULATE®...the triple-zone insulation that fuses itself into lifetime protection for hot underground pipes. Water-proof, corrosion-proof, root-proof, acid/alkali-proof.

Compare your present insulation methods with Gilsulation:

1. Pour Gilsulate granules out of the bag onto the pipe; tamp it down.
2. Backfill: *the job is insulated!*

Gilsulate—nature's own insulation—is a unique, solidified hydrocarbon that virtually installs itself. Normal pipe-heat (up to 520°F) does the rest—fuses the Gilsulate to the pipe in hours, forming a massive circular solidified sheath.

Gilsulate costs less installed per linear foot *than any other underground pipe insulation*... it's easiest to use... and has been tested in scores of the country's largest and most important installations.

Some additional Gilsulate advantages:

- *3 grades available*—220° to 520° F
- *needs no sleeves* or mechanical sheaths
- *requires no mixing* or special handling
- *can't be punctured* — leave rocks in backfill
- *pipe expands and contracts* within Gilsulate structure
- *proved in actual use* in hundreds of new construction and replacement installations

Send coupon for descriptive literature.

AMERICAN GILSONITE COMPANY
SALT LAKE CITY, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California

No skills necessary—simply pour Gilsulate out of 100 pound bags, tamp and backfill. Can be used under any and all conditions—no matter how many pipes, whatever the space.

GILSULATE®

THE TRIPLE-ZONE INSULATION
FOR LIFETIME PROTECTION
OF HOT UNDERGROUND PIPES.

American Gilsonite Company
248 South Main Street, Salt Lake City 1, Utah
or 1145 East Jersey Street, Elizabeth 4, N. J.

Please send me descriptive literature on Gilsulate.

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

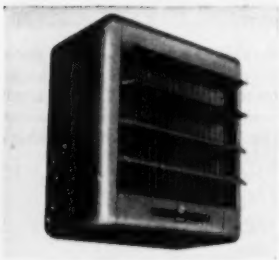
HPC

THE latest addition to the famous line of Herman Nelson unit heaters is the GAS FIRED model. The new heater is engineered to precision standards and designed for beauty and utility . . . finished in a smart grey-green baked enamel.

The new heater is operated equally well on all types of natural, manufactured or liquified petroleum gases . . . and it is available in seven sizes with heat input ranging from 25,000 to 200,000 B. T. U.'s per hour.

Another important feature of the new Herman Nelson Gas Fired Unit Heater is its economical installation. No expensive piping or boiler equipment is needed and for this reason it can be moved from place to place and will fit in small spaces.

Write for complete information to HERMAN NELSON HEATING AND VENTILATING PRODUCTS, DEPT. HP-12, AMERICAN AIR FILTER COMPANY, INC., LOUISVILLE 8, KENTUCKY



HORIZONTAL AND VERTICAL UNIT HEATERS

With the addition of the new Gas Fired Heaters . . . the already famous Herman Nelson line offers industry a complete range of models. Our Vertical and Horizontal Units, for operation with either steam or hot water, are available in a wide variety of sizes. These heaters are providing an economical solution to heating problems in thousands of industrial, commercial and institutional buildings where steam or hot water facilities are already available. They provide instant heat . . . *where* and *when* it is needed and *without waste!*

American Air Filter
COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF
herman nelson

by purifying and recirculating it

Outside air for ventilation is expensive to heat in winter and cool in summer. You cut such costs materially and still have plenty of pure, odor-free air by using Pur Air equipment. Air passed through Pur Air activated-carbon adsorbers is made even fresher than most air taken from outside. All odors and gases are removed. Saving heating and cooling costs by recirculation is like pulling money out of thin air.

We're doing just that at a new high school being built in Connecticut. This school will use 109 Pur Air "Filter Folds" in the heating and air conditioning system. By recirculating the deodorized and already heated air, a healthy annual savings will result.

We also found some dollars for the manager of the Atlanta Athletic Club. His swank new lounge was losing business because rugs, drapes and overstuffed furniture took on smoke, drink and food odors. We solved that one in the time it took us to plug in two of our Pur Air "A-10" portable units.

It only took a year for a Pur Air installation in a plastic plant to pay for itself. In this case, while removing odors, the system recovered over 2,000 gallons of valuable, reusable solvent daily from the air passed through it.

In cold storage warehouses Pur Air finds dollars by adsorbing food odors and ripening gases which prolongs normal storage life of fruits and vegetables.

Pur Air engineers will show you how activated-carbon purification and recirculation can pull dollars right out of the air. Call one of our 71 offices today for a no-obligation survey, or write for the facts.

Pur Air DIVISION
BARNEBEY-CHENEY Company
CASSADY & EIGHTH • COLUMBUS 19, OHIO

BARNEBEY-CHENEY COMPANY, PUR AIR DIV.
CASSADY & EIGHTH • COLUMBUS 19, OHIO

☐ *Send for FREE folder on Pur Air activated-carbon equipment.*
☐ *Have a Pur Air Representative call on me.*

Your Name _____
Firm Name _____
Address _____
City _____ State _____

COMPLETE UNITS READY TO INSTALL AS RECEIVED

You're many hours and dollars ahead when you solve your load problems with

BLAW-KNOX PIPE HANGERS

The Functional Hanger with its patented Internal Swivel Action, as well as Roller Assemblies and Vibration Eliminators, arrive on the job as complete units ready for installation "as is" . . . saving you expensive cutting, threading and assembling in the field. For any piping problem, you will find in Catalog #51 much technical data that will speed specifications and cut your engineering time. Send for it today.

BLAW-KNOX

BLAW-KNOX COMPANY
POWER PIPING AND SPRINKLER DIVISION
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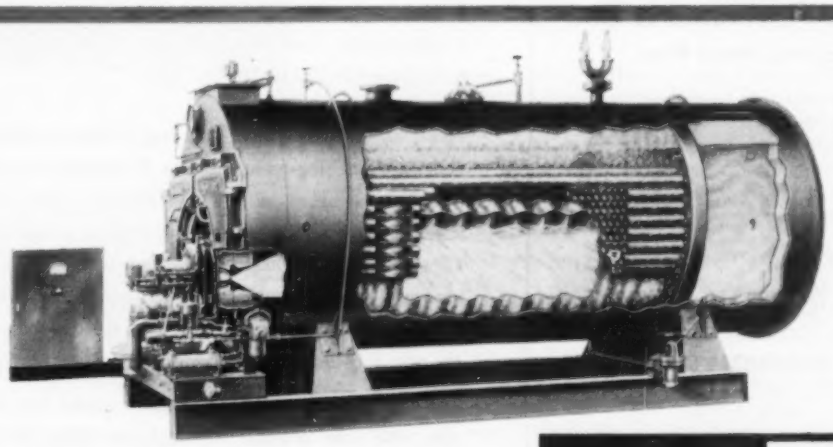
2 heads are better than 1 ... ...in designing boiler-burner units

■ It is just common sense that experts in any field thoroughly know their own products. So you can expect a better product in every way when you specify the Kewanee-Petro Boiler Burner Unit because you get the combined knowledge of leadership in 2 fields . . . boilers and burners. Here, two great companies bring together boilers and burners designed as complementary units with all parts perfectly integrated. Engineering and design have been combined for maximum efficiency and dependable production of high or low pressure steam and hot water heating using oil, gas or oil and gas combination. The Kewanee-Petro Unit is easily installed . . . simple to operate. The boiler, mounted on steel skids, has matched burner connections. All refractories are installed at the factory . . . forced draft burner eliminates necessity of a high stack . . . operation is completely automatic with all combustion controls mounted and pre-wired in one cabinet. Delivery from two separate factories offers important advantages. The boiler is usually wanted at the building site before the walls are up, and needing no protection from the weather, is shipped first. The burner, with control system, is delivered when wanted, after the building is roofed. It will pay you to get full information on this outstanding boiler-burner unit. Write either company, or mail the coupon.



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boiler–burner unit

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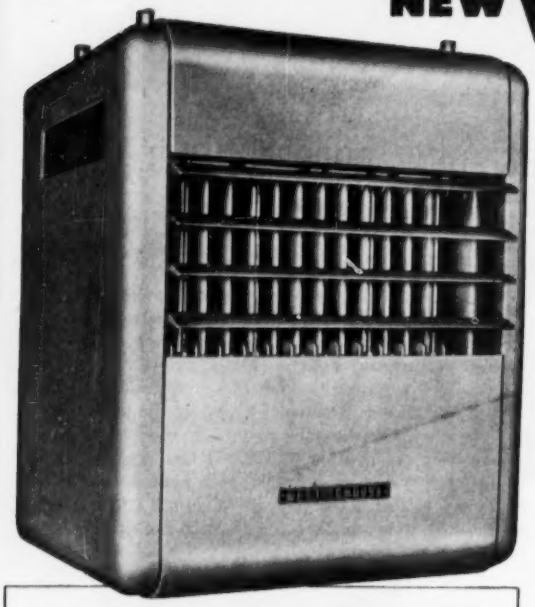
GAS-FIRED

SPEEDHEATER®



For store, office, factory or warehouse, check these 8 Westinghouse features:

1. Instant on-the-spot HEAT
2. Automatic controls—no attendant needed
3. Ceiling suspension—uses no working space
4. No heat loss as in central plant piping
5. Swift, easy, economical installation; simple upkeep
6. Fully approved safety controls
7. Handsome, functional styling—no finishing cost
8. 7 sizes—25,000 to 200,000 BTU

Heat starts right away—no long warm-up period. Self-contained, ceiling-mounted, the Westinghouse Gas-Fired Speedheater takes no valuable working space, needs no supervision, runs for low cost on natural, manufactured or LP gas. Adjustable louvres control distribution; fan will run separately for air circulation in summer. Get sure heat, save money on installation, avoid work, cut fuel bills—specify the new Westinghouse Gas-Fired Speedheater.

For full details on the Speedheater model best suited for you, call your nearest Westinghouse office for Catalogs 1521 and 1525, or write: Westinghouse Electric Corporation, Air Conditioning Division, Boston 36, Mass.

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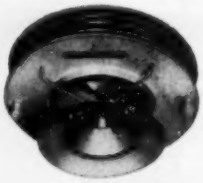
Meets Every Unit Heater Need



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HORIZONTAL SPEEDHEATER

Get 7 times more output than conventional radiators; save money and space. In addition to the new Gas-Fired units, Westinghouse Speedheaters are available in 82 standard sizes in steam and hot water units. Capacities range from 25,000 to 400,000 BTU in horizontal and vertical models to meet every application.

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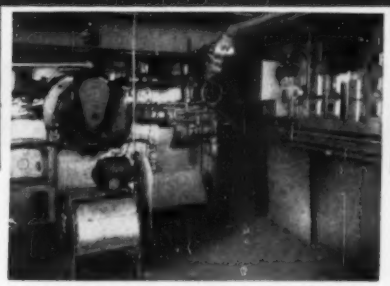
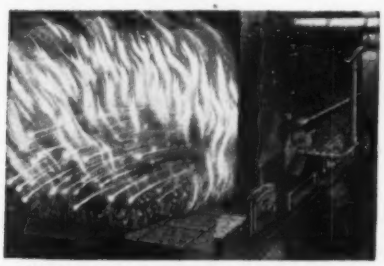
Dual or Triple Fuel Firing

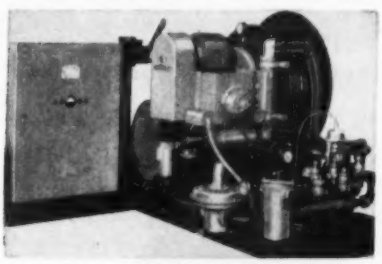
uses OIL, GAS or COAL



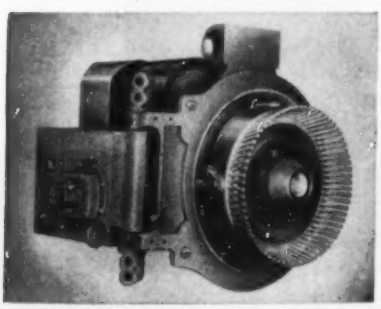
With this Iron Fireman installation the Hyde Park Laundry is able to burn coal, oil or gas at any time desired. Steady steam supply is required for both heating and processing.



GAS, OIL, COAL. Equipment includes Ring Type gas burner, Rotary oil burner, and Pneumatic Spreader coal stoker. Coal is automatically dried, preheated and conveyed from bunker to boiler. No manual handling; no costly conveying equipment.



GAS-OIL PACKAGE UNIT. For Scotch marine and other types of boilers. Has integral forced draft and control panel which is completely wired and tested at factory.



GAS-OIL BURNER. Ring Type gas burner and Rotary oil burner on single mounting. Fuels can be shifted quickly, with no loss of efficiency.

Fuel switch saves $510 in two months . . .

Hyde Park Laundry, Chicago, cuts costs by quick changeover

"Our past experience with our Iron Fireman stoker led us to investigate your gas and oil units along with several other makes," writes Mr. Morris Tabas, Manager of the Hyde Park Laundry. "Now we have Iron Fireman three-fuel operation—coal, gas and oil. With quick changeovers we needn't fear shortages, strikes, or what have you.

"During a two-months' period when we took advantage of seasonal gas rates, our fuel cost was $690 as compared to $1,200 with other fuels for a like period and load."

Burns all fuels efficiently

Efficiency ratings are high with oil, gas or coal. As price advantage shifts from one fuel to another your steam plant can shift with it—for the long pull if necessary. Or you can change fuels every day when desirable. This is routine practice in many companies where the gas supply is reduced during peak periods.

Avoid costly shut-downs

Fuel emergencies, due to interrupted or short supply, can be disastrous. Yet protection may cost little or nothing when offset by the fuel and labor savings of Iron Fireman multiple fuel firing.

For further information write Iron Fireman Mfg. Co., 3070 West 106th Street, Cleveland 11, Ohio.

Iron Fireman

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FOR HEATING, PROCESSING, POWER

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WHO PUT THE ERASER ON THE PENCIL

We don't know his name, but we do know it is a great idea; it makes for easy accessibility. This singular important factor increases its usefulness a thousand times.

A sound thinking engineer would say, "Easy accessibility greatly improves the usefulness of all equipment and machinery, even to the point that it sometimes is the greatest influence to their decision."

Easy accessibility to all parts and accessories of an Olson Heater is another contributing factor that makes it the intelligent heater selection.

The fact that Olson Heaters are built rugged for dependable service cannot be denied. — Write for the detailed step-by-step catalog and you'll know why.

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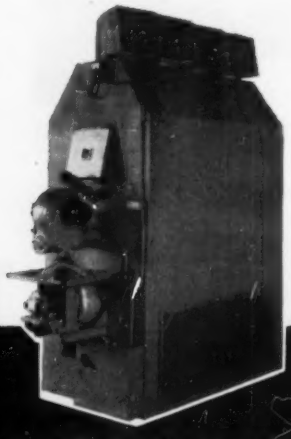
Gas, Oil, Coal or Dual Gas and Oil



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from large fans, blowers, and air-conditioning units.

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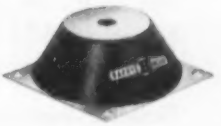
describes the first really *engineered* approach to the problem of isolating vibration and noise produced by heavy fans, blowers, and ventilating and air-conditioning units.

The key to effective reduction of both vibration and audible noise transmitted through the building structure is an isolating base *made for the job* — specifically engineered to take account of the weight of the fan plus its motor and housing, the location of the center of gravity of the mounted equipment, and the operating speed. BARRY FAN BASES ACHIEVE MAXIMUM EFFICIENCY BY CAREFUL ATTENTION TO ALL THESE FACTORS.

These new bases incorporate isolators of special design, each selected to carry its proper load, in an integral structure of supporting rails manufactured to the individual requirements of each installation. This is the only way to get reliable results — and because this is the BARRY way, your satisfaction is guaranteed.



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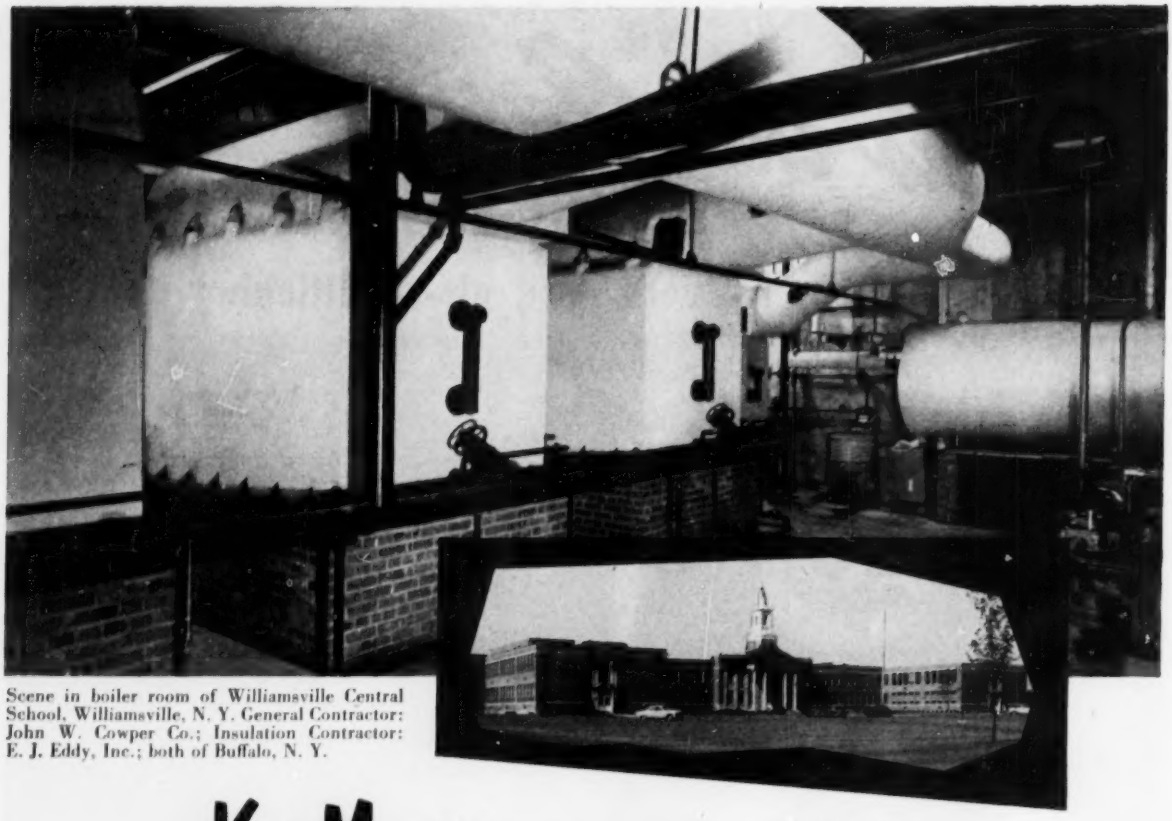

Scene in boiler room of Williamsville Central School, Williamsville, N. Y. General Contractor: John W. Cowper Co.; Insulation Contractor: E. J. Eddy, Inc.; both of Buffalo, N. Y.

K&M offers you a complete line of THERMAL INSULATIONS

For the insulation of equipment and piping in the Williamsville Central School, K&M Thermal Insulations were used exclusively.

Boilers, heat exchangers, breeching, and all exposed supply and return risers were covered with "Featherweight" 85% Magnesia. All supply mains and concealed risers were covered with K&M Simplex "Super Shrunk" White Glazed Pipe Insulation.

All K&M Insulations are easy to apply, dependable, and highly efficient in their respective ranges. They are made in various forms to suit any application.

Ask your distributor to show you these fine products, or write directly to us for detailed information.

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Keasbey & Mattison has made it serve mankind since 1873

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On large ductwork jobs...
THIS PHOTO shows part of the huge ductwork installation in the second floor ceiling of the National Technical Center.
Architects and Engineers: Dalton-Dalton Associates, Cleveland. General Contractor: The Leonard H. Krill Co., Inc., Cleveland. Structural Steel By: Builders Structural Steel Corp., Cleveland. Sheet Metal Supplied By: Riester & Thesmacher Co., Cleveland.

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THIS large ductwork installation for the heating system of the new National Malleable and Steel Castings Company's Technical Center in Cleveland, Ohio, is typical of the many large jobs that are entrusted to U·S·S Galvanized Steel Sheets. For heating and metal-working men know that for good, time-saving workmanship—neat, long-wearing finished jobs—and satisfied customers, there's no better sheet to use than U·S·S Galvanized.

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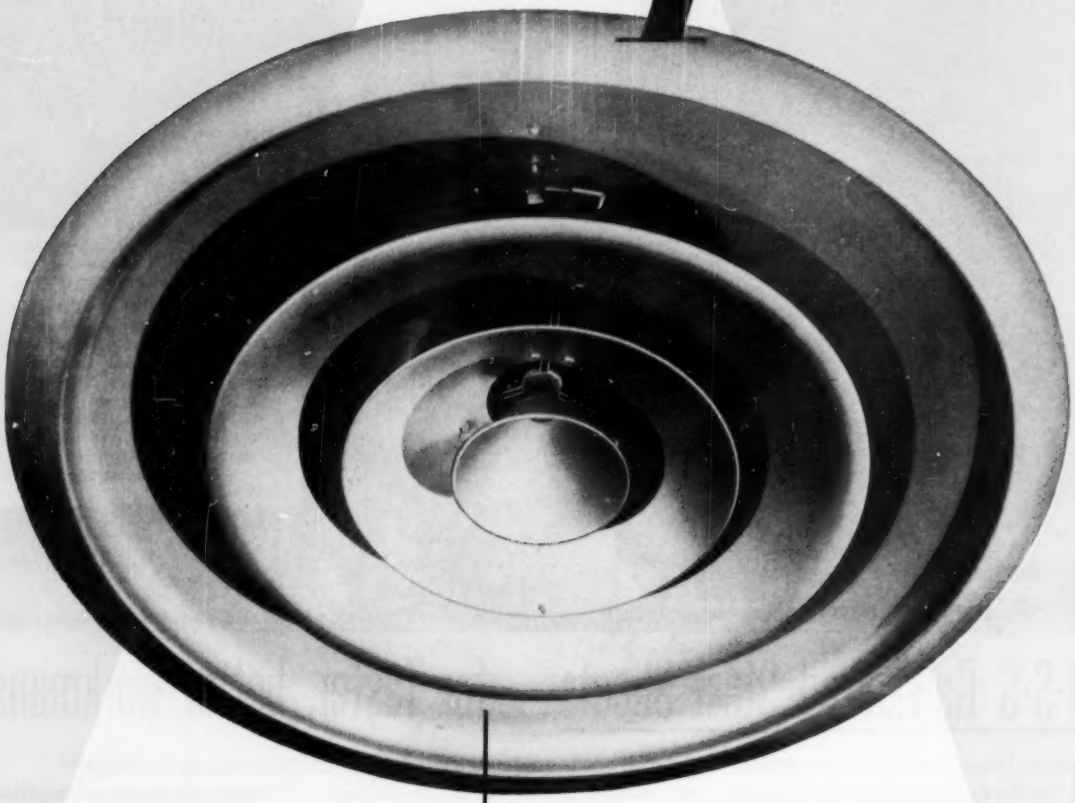

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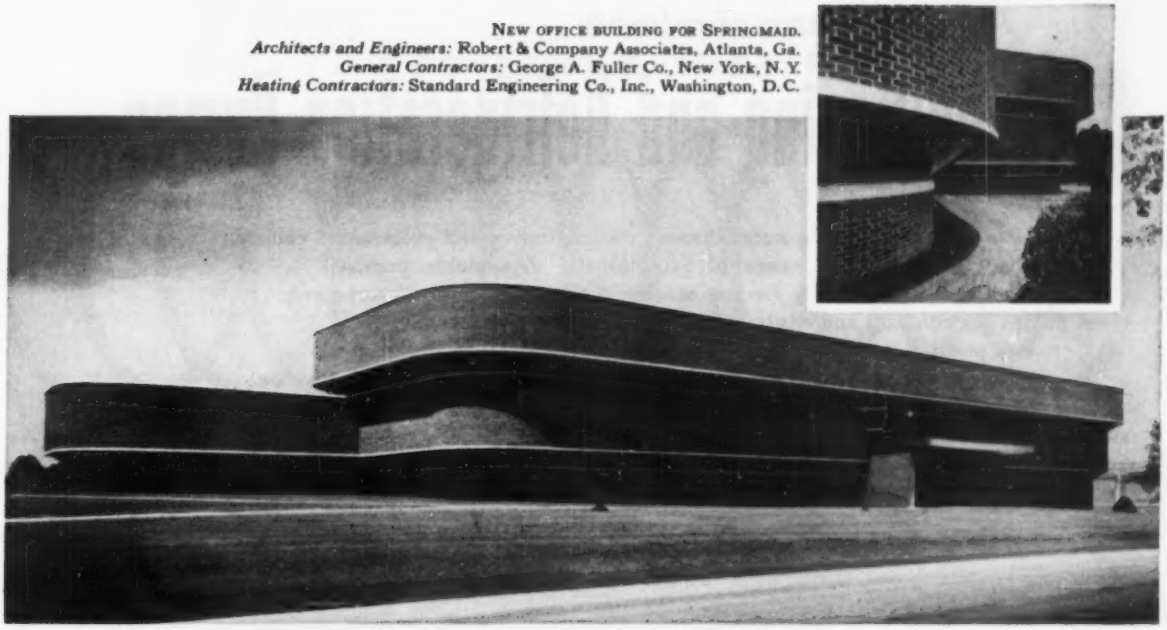

SARCOTHERM *Controls Radiant Heating System in Springmaid's Unique Home Office*

UPSIDE-DOWN WINDOWS, "floating" ceilings, and radiant heated walls tell the story of Springs Cotton Mills' remarkable new building in Fort Mill, S. C.

Sarcotherm weather modulated controls were specified for the building's unusual heating system which operates through radiant panels installed in the walls. The system is divided into seven zones, each of which is regulated by a Sarcotherm Indoor-Outdoor control. Thus each zone is assured comfort regardless of location and outside temperature conditions.

Sarcotherm provides a simple, low-cost way of achieving accurate, sensitive control of radiant and hot water heating systems. Coupled to these distinct advantages is Sarcotherm's extensive engineering service which can help you design and install the most efficient and trouble-free system possible.

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SARCOTHERM CONTROLS, Inc.

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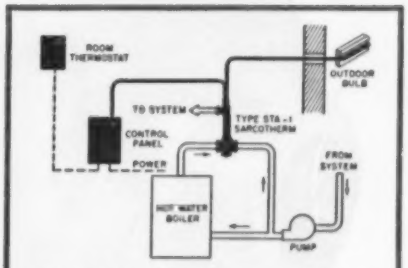

Typical of the Springmaid installation is this hookup. Proportioning type mixing valve continuously modulates water temperatures.

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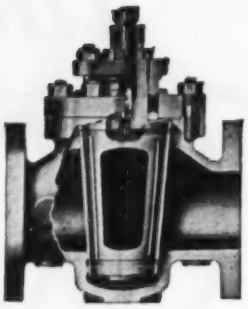
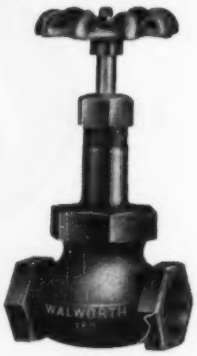


Walworth
Lubricated Plug Valve

Walworth
Steel Gate Valve

Walworth
Iron Body Gate Valve



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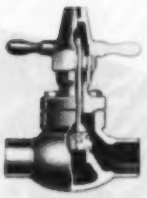
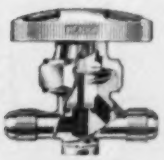


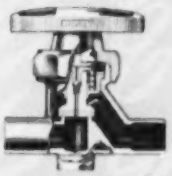
Wing Cap Valve

Drier

Ammonia Valve

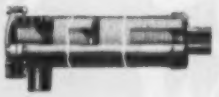


Packless Valve With
Balanced-Action
Blue Bantam Type



Packless Valve With
Balanced-Action
Standard Type

"Y" Strainer



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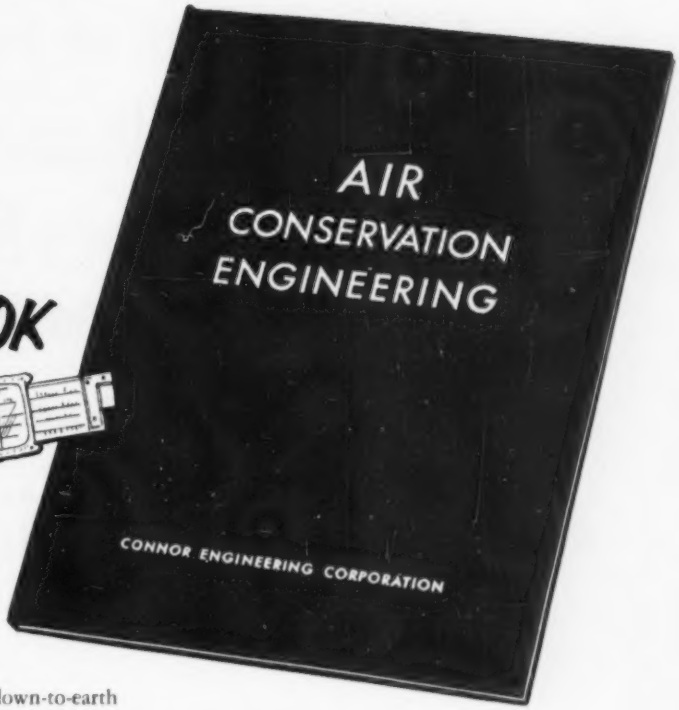

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the biggest sales booster to hit the hot water heating field in years!

Weatherbrain indoor-outdoor control regulates room temperature all winter long without ever a manual adjustment.

Now you can cash in on big, new profits in the hot water heating field with DETROIT'S amazing Weatherbrain Control.

That's because Weatherbrain indoor-outdoor control offers heating comfort never before possible in forced hot water heating systems—constantly uniform and completely automatic. Once installed, the user never makes a manual adjustment of any kind. The Weatherbrain Control's outdoor bulb senses changes in outside temperature and responds instantly by supplying the exact amount of heat to keep room temperature right where it should be! And because it is entirely mechanical in operation with no expensive, complicated electronic gadgets to go wrong, Weatherbrain Control is less costly and more easily installed than any other control of its type. See your DETROIT wholesaler or write for Bulletin No. 254.

CHECK THESE FEATURES

- Varies the water temperature delivered to panels or radiation in exact accordance with the demands of the weather.
- All mechanical; no delicate mechanisms, electronic tubes or relays.
- Well adapted to zone systems because of its simplicity and reasonable cost, and where the electrical boiler resetting type control will not work.
- Gradual changes in water temperature in the system minimize the undesirable effects of thermal expansion and contraction.
- Very valuable where more than one type of radiation is used.

ESTABLISHED AS DETROIT LUBRICATOR COMPANY IN 1877

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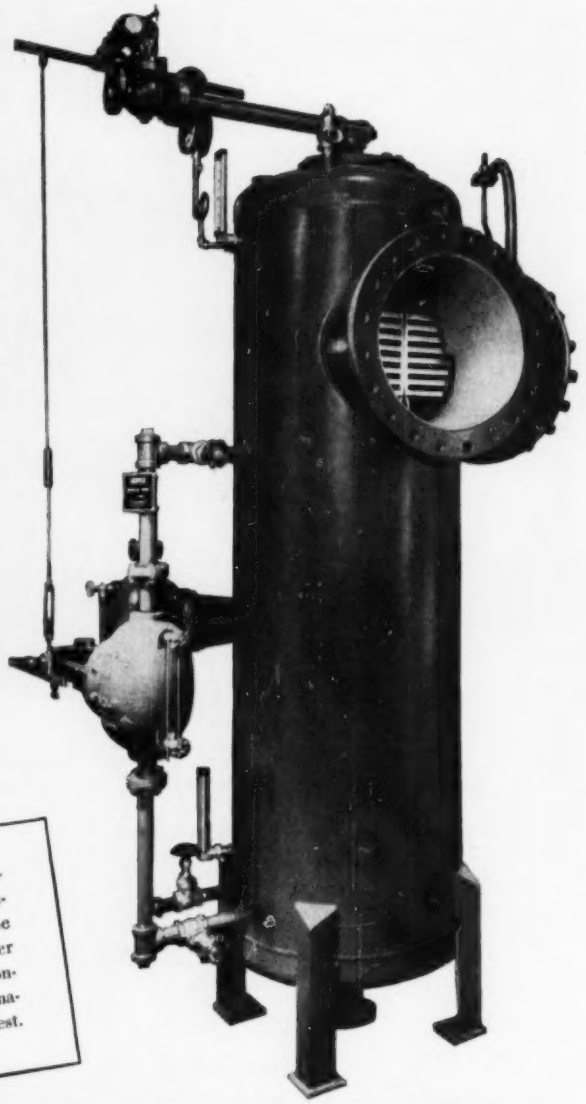
everything needed for easy, quick installation

When you buy a Graver Packaged Deaerating Heater, it comes to you *complete.*

This means that the unit includes *all* internal parts, controls, valves and instruments you need for the installation. There will be nothing to wait for . . . nothing more to buy.

And *shipment* will be quick, too, because these units are *standardized* . . . pre-engineered for your speedy selection from a wide range of capacities in either the spray or spray-tray types.

While these Graver Packaged Heaters are built in sizes for the *smaller* plant, every part and every accessory is of the highest quality design, construction and workmanship . . . subjected to the same rigid specifications as the Graver Heaters of 1,000,000 lb. per hr. or more, built for the largest power generating stations.



If you are concerned with the purchase, installation or operation of a deaerating heater for a steam generating plant requiring up to 100,000 lb. per hr. of boiler feedwater, be sure to investigate this Graver Packaged Deaerating Heater of the spray or spray-tray design. Descriptive bulletin containing complete information including dimensional information in a range of standard capacities will be sent on request.

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GW-413

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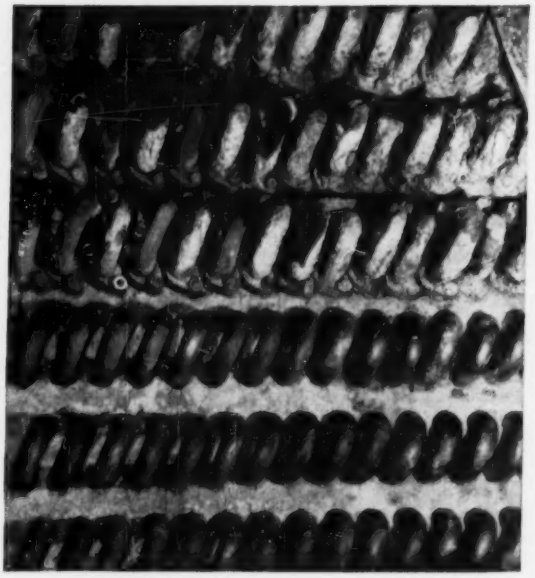
TUBE TURNS' *Engineering Service*

shows the way to eliminate equipment shutdowns

● In the past, directional changes in the tubes used in fuel economizers for boilers have been made with flanged U-bends or with header boxes. Although leakage was inevitable sooner or later, and repairs difficult, such conventional connections were necessary to permit periodic dismantling and mechanical cleaning.

Now, improved methods of water treatment have eliminated the need for such cleaning in most cases, and with it, the need for joints that can be readily disassembled. Accordingly, TUBE TURNS' Engineering Service has recommended re-fabricating tube assemblies with TUBE-TURN 180° Welding Returns, which are available in thicknesses and radii to match the tube walls and centers of most economizers.

The result has been the elimination of any leakage in economizer tubing, thus ending shutdowns of economizers, boilers, and other critical equipment. In addition, pressure drop is reduced, and flow conditions improved. When you have a tough piping problem, bring it to TUBE TURNS' Engineering Service—a service that typifies TUBE TURNS' leadership in piping engineering.



At top: flanged connections in economizer. *At bottom:* permanently leakproof, TUBE-TURN Welding Returns.

Shop fabrication of welded piping assemblies is easy, thanks to the uniform wall thickness and dimensional accuracy of TUBE-TURN Welding Fittings. Line-up is fast and accurate.

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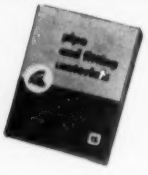

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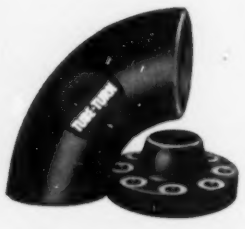

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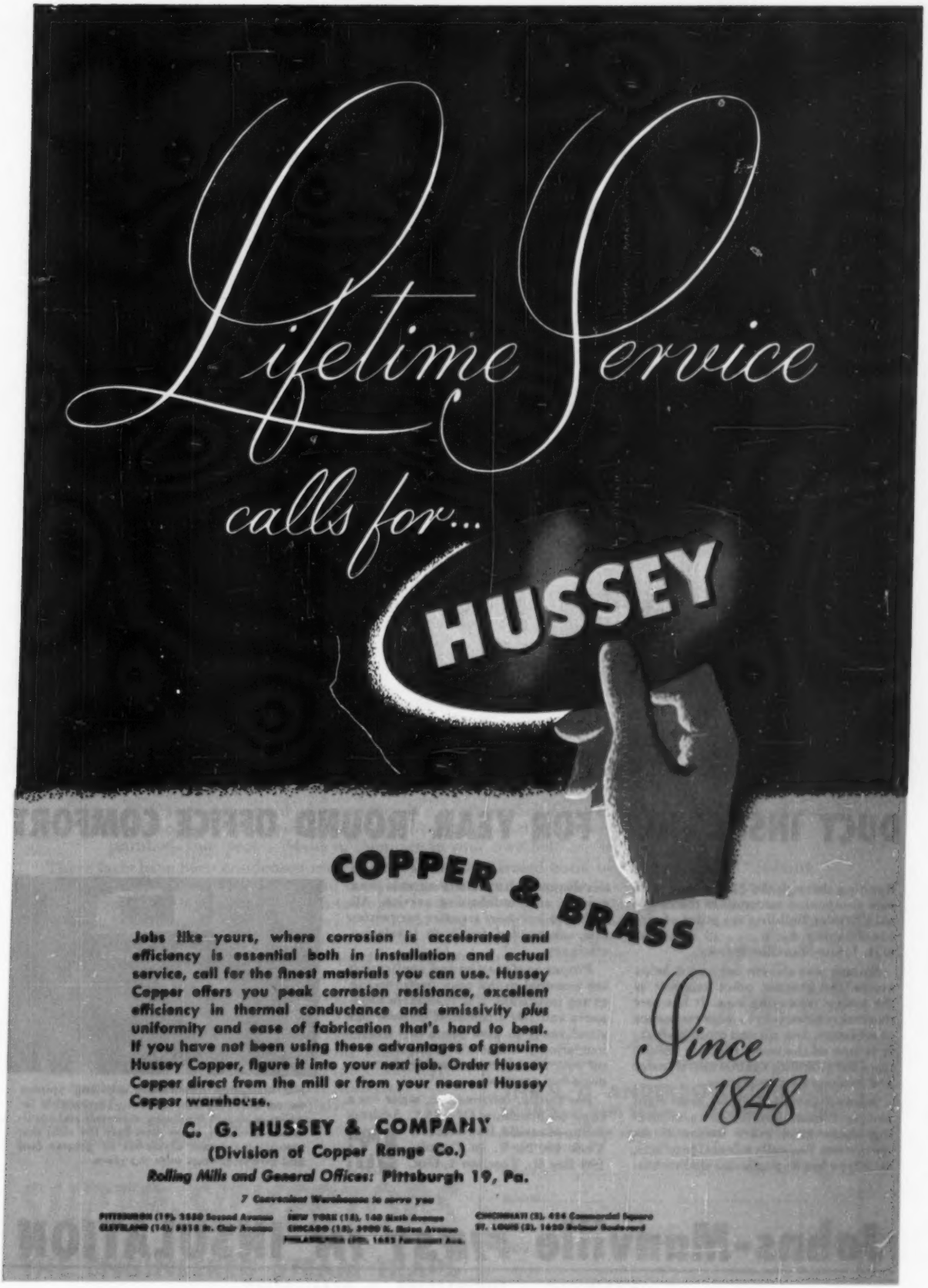
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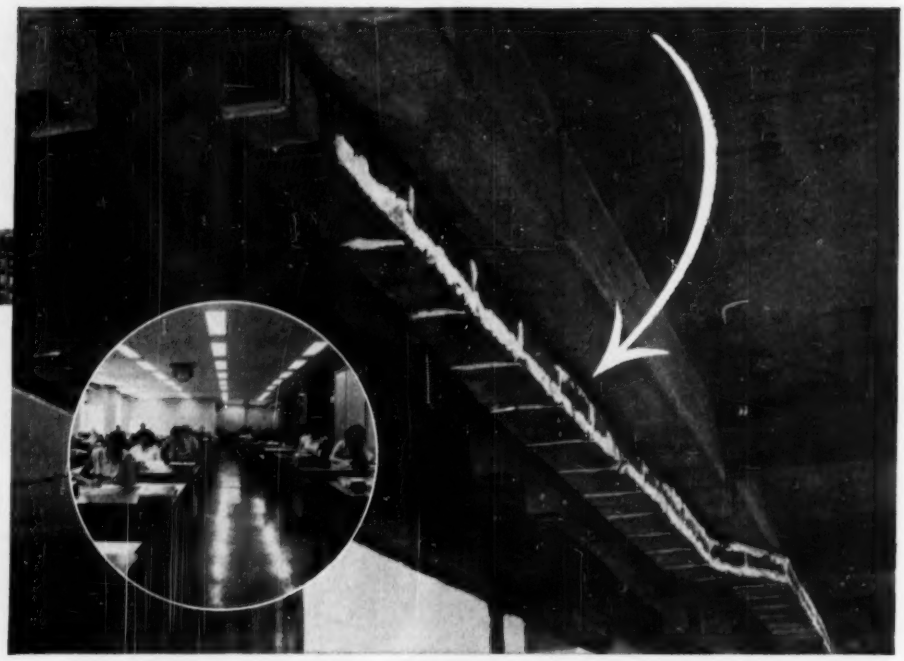
Above: New York City's new Chrysler Building East (foreground) and the original Chrysler Building erected some 20 years ago.

Right: Spintex insulation on the air-conditioning ducts serving offices in the Chrysler Building East. Applied by the Asbestos Construction Company, Inc. of New York, an outstanding J-M Insulation Contractor.

On air-conditioning ducts serving 420,000 sq ft of office space . . .



CHRYSLER BUILDING EAST SPECIFIES J-M *Spintex* DUCT INSULATION FOR YEAR 'ROUND OFFICE COMFORT

Running through the 32 stories of the new companion structure to the original Chrysler Building are miles of air-conditioning ducts . . . all insulated with Johns-Manville Spintex.

Spintex was chosen because it helps assure the greatest office comfort at the lowest operating cost. It has low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth. It is one of the most effective insulations for guarding against heat transfer and moisture accumulation.

Johns-Manville flexible, semi-rigid and rigid insulations for air-conditioning ducts meet every industrial requirement. Basically mineral products, each type has its particular characteristics that make it specially suitable for a specific air-conditioning service. All have the low heat transfer properties that are needed for high insulating efficiency.

Proper engineering and application are essential to the peak performance of any insulation. J-M Insulation Engineers and J-M Insulation Contractors stand ready to give you a top quality insulation job that will more than pay off your initial investment with maximum fuel savings.

For further information, write for a copy of Brochure IN-135A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.

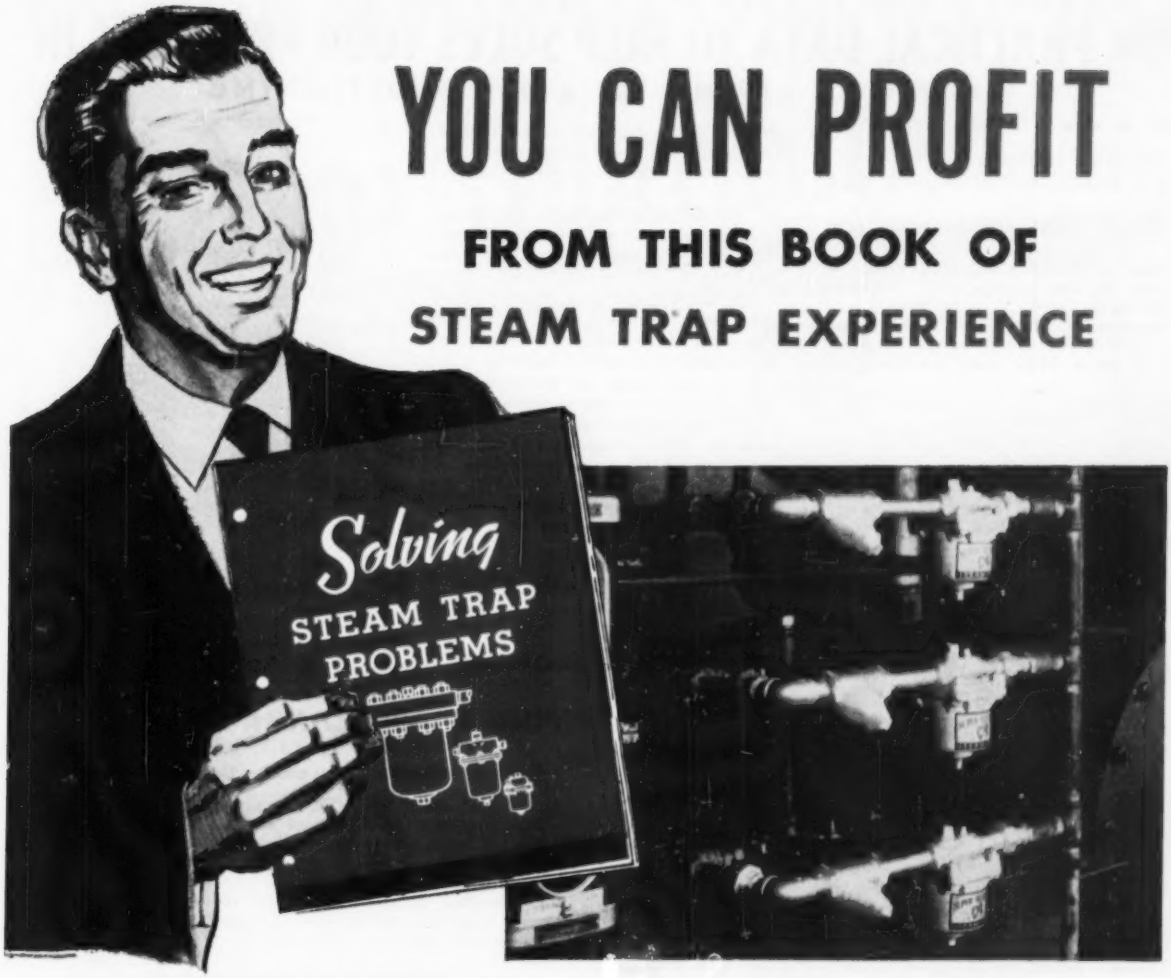
J-M Insulation applicators applying Spintex on an air-conditioning duct. Thoroughly familiar with J-M insulating materials and application methods, these men have the skill that assures maximum dividends in greater fuel and power savings over the years.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

YOU CAN PROFIT

FROM THIS BOOK OF STEAM TRAP EXPERIENCE



● The tough school of experience is a great teacher. Over the years Anderson engineers have gathered an immense quantity of data on how other companies have changed steam trap problems into profits. Many of them are in your own field.

These facts have been condensed into a fast-reading, illustrated book of 36 pages called "Solving Steam Trap Problems". You'll find many suggestions in it on how to cut costs of trapping condensate in your plant. As an example, it shows how you can install a steam trap so that you can easily service the trap without disturbing a single pipe fitting . . . saving up to half an hour every time you inspect the trap, or replace the valve and seat. You'll find many other suggestions on how to select the right steam trap for maximum efficiency on every job.

Anderson invites you to share its long cost-cutting experience. Send the coupon today or write on your letterhead.

Super-Silvertop Steam Traps are right for each job . . . installed faster, serviced quicker than any other trap. Made by the V. D. Anderson Company, manufacturers of Hi-eF Purifiers, Anderson Strainers, Silvertop Air Release Valves and other products of exceptional quality and value.

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134 pages, 8½" by 11", $1.50.

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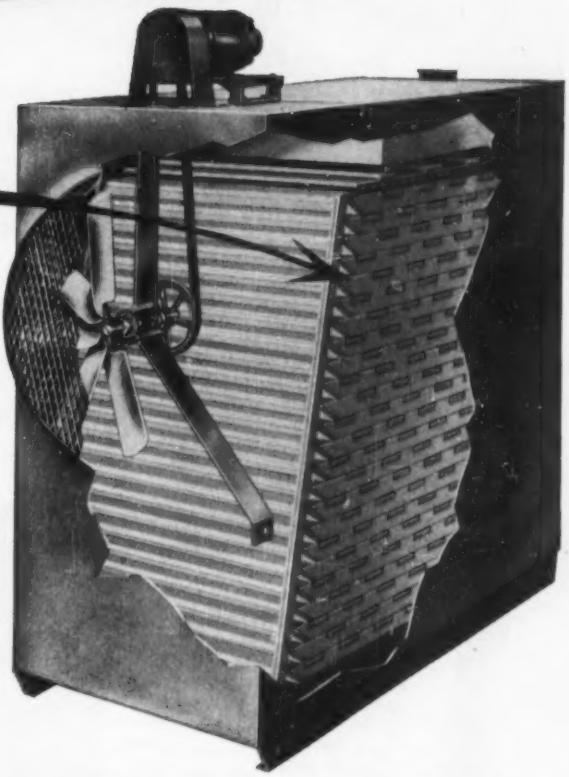
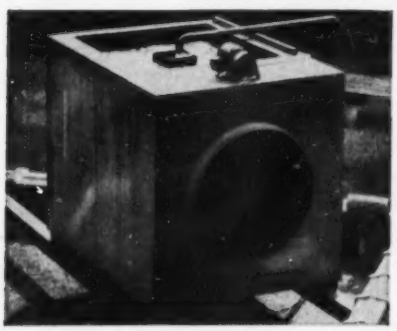
HALSTEAD & MITCHELL COOLING TOWERS

20-Year Guarantee!

On the Wetted Deck Surface of Koppers Pressure-Treated Wood



Here's the industry's greatest cooling tower value . . . "built like a battleship" for 20 years of foolproof performance. Halstead & Mitchell's pioneering in exclusive use of Koppers pressure-treated wood in the wetted deck surface makes possible the unprecedented 20-year guarantee against rotting, and provides the industry's most effective deterrent against fungi growth. Economical, lastworthy . . . the special H & M design for water distribution eliminates, thru the use of an efficient gravity-type distributing pan, extra pumping head required on spray type towers, also cuts down windage losses due to atomizing of water. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service. Easily accessible for cleaning through inlet on back of towers in all sizes.



MORE EFFICIENT IN ANY INSTALLATION

H&M #CT-4000 Induced-Draft Cooling Tower supplying the condensing water for 20 HP and 10 HP water-cooled condensing units in 3-story jewelry storeroom air conditioning. Note open-type distributing pan. This installation also has remote water basin in basement for year-round operation.

2 TONS to 100 TONS

A cooling tower for all applications, from 2 to 100-ton capacities—made by Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers.

AT LEADING WHOLESALERS EVERYWHERE

Write for descriptive bulletin and information on engineering helps.

HOUSING—10 gage (1/8"+) sheet-steel case with 3 coats Bitumastic lining. Electrically welded cabinet. All bolts used are Everdur for ease of disassembly after years of service.

WATER DISTRIBUTION—Gravity type distributing pan eliminates extra pumping head, cuts down windage losses, due to atomizing water.

FAN AND DRIVE—Quiet-operating stainless steel 8-bladed fan, stainless steel shaft, chrome-dipped rust-proofed pulleys. Cast iron bearing supports. Adjustable belt tension.

HM

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NEWS FOR YOUR INDUSTRY....

Libbey·Owens·Ford Announces Super·Fine Fiber·Glass Furnace Insulation

A new line of facings applied to Super·Fine Fiber·Glass insulating blankets has been announced by Fred W. Segerstrom, manager of Super·Fine sales for Libbey·Owens·Ford Glass Company in Toledo. The new line includes aluminum foil reflective facings widely used in the furnace industry.

The facings, Mr. Segerstrom said, may be applied to any standard Super·Fine insulation regardless of thickness or density of the blanket.

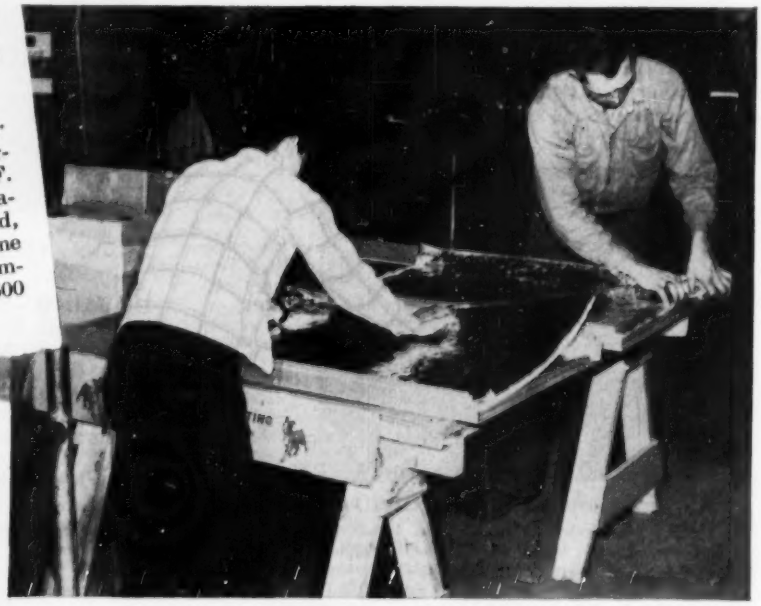
High Thermal Protection

Super·Fine is an outstanding product for high thermal insulation protection. Addition of an aluminum facing gives the product additional advantages of a reflective surface, Mr. Segerstrom pointed out. In addition to aluminum foil, he indicated, other types of facings are available.

Withstands 450° to 600° F.

Regular Super·Fine Fiber·Glass withstands temperatures up to 450 degrees F. For specialized application, Mr. Segerstrom said, L·O·F makes Super·Fine with binder #22 for temperature ranges to 600 degrees F.

A high temperature adhesive is applied to the side casing of Bryant gravity-type furnace, model GH 57. It is now ready for the application of Super·Fine.



Applying Libbey·Owens·Ford Super·Fine Fiber·Glass insulation with aluminum foil reflective facing to side casings of Bryant furnaces. The aluminum foil facing provides additional insulation by reflection of radiant energy.

For further information about Super·Fine with binder #22 and foil facing, contact your nearest L·O·F office (offices in 26 cities). Or write Libbey·Owens·Ford Glass Company, Fiber·Glass Division, 39123 Wayne Bldg., Toledo 3, Ohio.

L·O·F GLASS Corrales FIBER·GLASS

FIBER · GLASS

LIBBEY·OWENS·FORD GLASS COMPANY
FIBER·GLASS DIVISION

"Daddy's stuck, mommy"

It happens so often at the end of a wintry day. Your car has carried you faithfully, from one business call to another, over streets and roads passable by public snow removal equipment.

Then dead-tired at nightfall, and within sight of your family and the warmth of your fireside, you get stuck in your *own driveway!*

To be "snowbound" fifty feet from home is an exasperation many of us have shared . . . but a totally unnecessary one. Modern driveway and sidewalk snow melting systems prevent it and should be as much a part of the modern American scene as the integral garage or the automobile itself. Amortized over the lifespan of the home and financed as part of the mortgage, or later as part of an improvement loan, the cost per year is negligible compared with the safety, convenience, increased property value, and collateral benefits derived.

Reliable *steel pipe,* proved in over 60 years of hot water and steam heating, is the most widely used heat transmission medium for snow removal systems. For steel pipe is economical, durable, readily formable and weldable for coils and grids, and is "familiar" to plumbers and pipe fitters everywhere.

Public interest in "domestic" sidewalk and driveway snow melting is high, due to the dramatic success of commercial installations seen in metropolitan areas. A *new* 32 page color booklet, "Steel Pipe Snow Melting and Ice Removal Systems". will help you capitalize on this interest and is available without charge or obligation. Write

Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH

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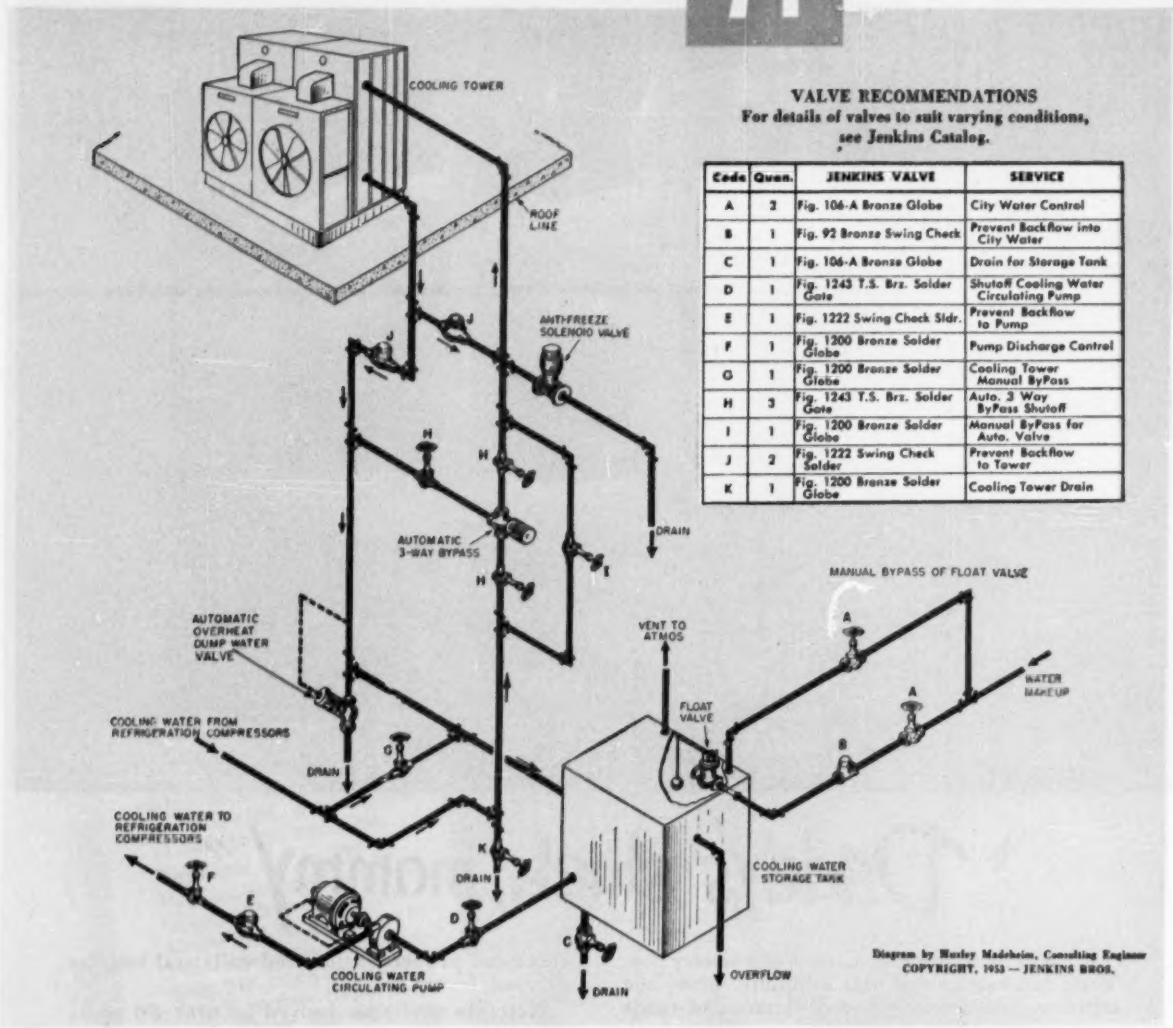
JENKINS PRACTICAL PIPING LAYOUTS 71



VALVE RECOMMENDATIONS
For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	JENKINS VALVE	SERVICE
A	2	Fig. 106-A Bronze Globe	City Water Control
B	1	Fig. 92 Bronze Swing Check	Prevent Backflow into City Water
C	1	Fig. 106-A Bronze Globe	Drain for Storage Tank
D	1	Fig. 1243 T.S. Brz. Solder Gate	Shutoff Cooling Water Circulating Pump
E	1	Fig. 1222 Swing Check Sldr.	Prevent Backflow to Pump
F	1	Fig. 1200 Bronze Solder Globe	Pump Discharge Control
G	1	Fig. 1200 Bronze Solder Globe	Cooling Tower Manual ByPass
H	3	Fig. 1243 T.S. Brz. Solder Gate	Auto. 3 Way ByPass Shutoff
I	1	Fig. 1200 Bronze Solder Globe	Manual ByPass for Auto. Valve
J	2	Fig. 1222 Swing Check Solder	Prevent Backflow to Tower
K	1	Fig. 1200 Bronze Solder Globe	Cooling Tower Drain

How to plan PIPING CONNECTIONS *for a* NON-FREEZE COOLING TOWER

Where uninterrupted refrigeration is a round-the-clock operating requirement, a non-freeze cooling tower of the type illustrated here offers a dependable supply of cooling water at low cost. It also conforms with the water conservation regulations now enforced in many localities.

Since cooling tower and compressors must operate on the same schedule in any continuous refrigeration system—even when temperatures are below freezing—the water used in this system is stored in a vented or open tank located in a heated space, rather than in the conventional pan under the exposed tower.

When freezing weather occurs, an anti-freeze solenoid valve, actuated by a temperature-sensitive device, opens to drain all water from lines exposed to outside temperatures. The automatic 3-way solenoid valve permits the water to bypass the cooling tower under freezing conditions, or when it becomes too warm due to fan failure or overload in the storage tank. Under the latter conditions, the automatic overheat dump valve would also open. The subsequent drop of the water level in the storage tank causes the float valve to open and admit city water to make up the deficiency. Thus, in an emergency, city water would be used for cooling.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To simplify planning, to save time, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 71.

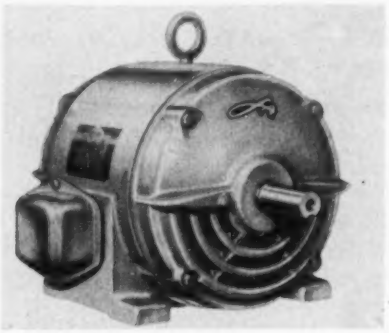
JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864
Jenkins Bros.

EQUIPMENT DEVELOPMENTS . . .

Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

Electric Motors

New "L.A." line of electric motors in open drip-proof, totally enclosed fan cooled and explosion proof enclosures in ratings up to 40 hp at 3600 rpm. . . . These new motors are built in accordance with the new NEMA frame size standards. The line features modern styling, improved ventilation, new conduit box arrangement, new bearing construction and more versatile mounting, the company states. The new line, which is lighter and more compact, has the same mechanical strength as previous larger models and has comparable starting and breakdown torque, power factor, temperature rise and

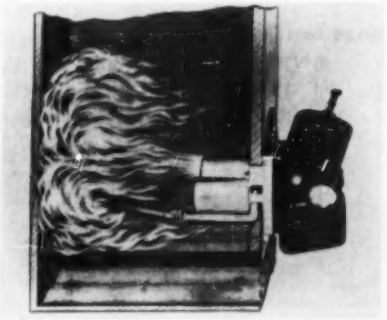


service factors. More effective ventilation is said to be due to better utilization of aerodynamic principles. Back-end bearings are locked in place by a bearing cap. Both open and enclosed motors have a split conduit box that separates into halves for easier electrical connection. An alternate conduit arrangement for the open, drip-proof motor is said to permit omission of the conduit box entirely where the motor must be used in crowded quarters.

Manufacturer—The Louis Allis Co., 427 E. Stewart St., Milwaukee 7, Wis.

Pulse-Jet Burner

** Two-phase pulse-jet burner designed to generate intense heat for field and indoor situations. . . . In the first stage of operation the "Swingburner" manufac-



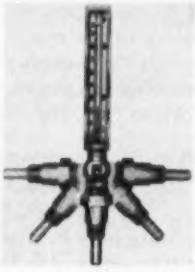
tures a hot exhaust stream which is fed into an expansion chamber. Simultaneously, the pulse-jet action of the heater supplies sufficient pressure to its fuel tank to feed a stream of gasoline into the chamber. The hot exhaust then merges with the fuel and air. Heat output ranges from 24,000 to 120,000 Btu's per hr.

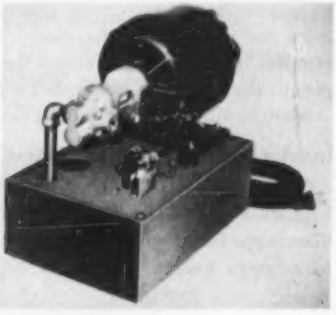
Manufacturer—Devenco Inc., Swingfire Div., 150 Broadway, New York 38.

Condensate Pump for Air Conditioning

*One-third hp pumping unit, "Model CCC" designed to remove water from drain line of air conditioning units, overflow water from water coolers, etc. . . . . According to the company, this unit is specifically designed to be used under conditions where it is inconvenient to pipe the water to a sewer drain line. The pump has a capacity of 1½ gpm at 100 lb discharge pressure which is said to make it possible to connect the pump discharge into condenser water or chilled water lines on air conditioning units without running lines to the cooling tower. An automatic float switch of the mercury type keeps the water moving from the tank as it accumulates from the connected drain line.

Manufacturer—J. P. Ashcraft Co., 5643 Dyer St., Dallas 6.





Above: Thermometer
Right: Pump

Adjustable Industrial Thermometer

New instrument with a 5-in. case to supplement the manufacturer's line of larger size thermometers. . . . According to the company, it can be positioned to any angle through a 180 deg arc, back or front, left or right. Danger of breakage due to shock or vibration is said to be minimized because of the flexible connection. The "Adjust-Angle" can be supplied with all standard fittings and all standard ranges up to 750 F, the manufacturer states.

Manufacturer—Weksler Thermometer Corp., 49 W. 32nd St., New York 1.

Blower Condensers

Expansion of company's line of replacement condensers to include a new line of blower condensers . . . . According to the company, advantages of blower condensers are water saving features and low maintenance cost in their use in condensing refrigerants. The new line will contain the manufacturer's patented inner-fin in the condenser surface. Propeller type fans are used to cir-

EQUIPMENT DEVELOPMENTS . . .

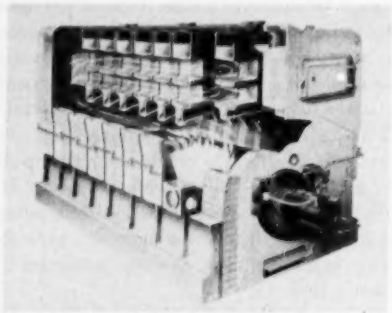
[Continued]

culate air over the condenser surface. Units are available in 2, 3 and 5 ton capacities.

Manufacturer—Bush Mfg. Co., 179 South St., West Hartford 10, Conn.

Boiler for Oil Burners

New development in Series 40 and 44 heavy duty boilers to adapt them for operation with horizontal rotary oil burners. . . .A special front section and steel mounting plate is said to simplify burner setting and alignment. The size and location of the various openings in the steel plate are in accordance with the specifications

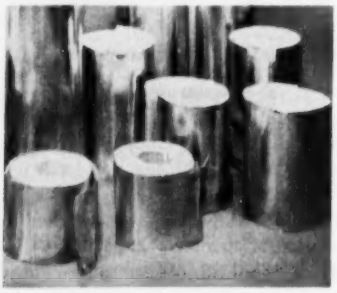


of the burner to be installed. The plate is bolted to the front section of the boiler to permit attachment of the burner. An access door is provided in the base for servicing the combustion chamber. According to the manufacturer, sectional construction and short tie-rod assembly permit the boilers to be erected without special equipment.

Manufacturer—Weil-McLain Co., Michigan City, Ind.

Insulation for Baseboard Radiation

"Alfol" asbestos No. 103, reflective-type insulation developed for heating use. . . It consists of aluminum foil bonded by a special heat-resistant adhesive to asbestos paper. It is reported that this adhesive will

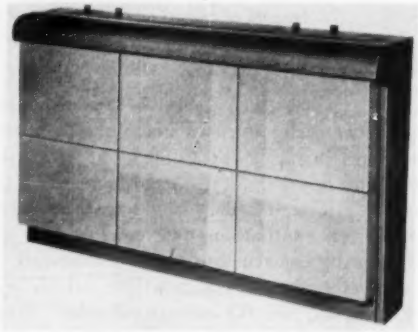


not soften or bubble under heat, will not run, form odors or permit the foil to peel. The asbestos is packaged in rolls of 100 lineal ft and seven stock widths ranging from 6 in. to 36 in.

Manufacturer—Reflectal Corp., 155 E. 44th St., New York 17.

Packaged Air Conditioner

Factory assembled air conditioner which requires only piping and electrical connections. . . . The unit uses cold water for summer cooling and hot water for winter heating. Cold or warm air, cleaned by large filters, is discharged into the room by two-speed blowers. Each room can be individually controlled. Specially designed coils are used for both cold and hot water. A removable front panel permits access to all inside parts.

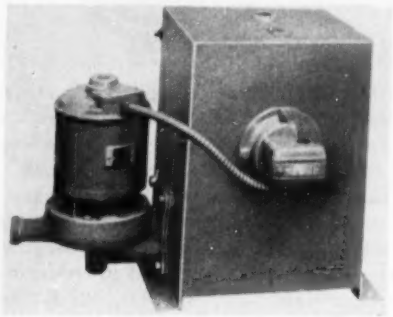


Controls are located behind the panel. Condensate is collected in a drip pan. The unit is made in sizes of 1½, 1 and ⅝-ton.

Manufacturer—Brown Products Co., 97-12 Metropolitan Ave., Forest Hills, N. Y.

Condensate Pump

Redesigned line of condensate pumps to cut operating, maintenance and installation costs . . . . The stuffing box maintenance is said to have been eliminated by the manufacturer's mechanical seal. The company claims that operating and maintenance costs will be

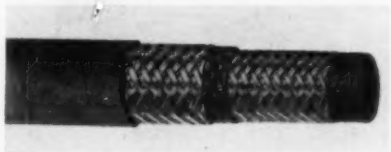


reduced because this pump does not depend upon any close clearances to hold its rated discharge and pressure. The pumps can be installed without the use of bars or bed plates.

Manufacturer—C. A. Dunham Co., 400 W. Madison St., Chicago 6.

Flexible Hose for Refrigerant Gas

"Qua-Seal" flexible hose for "Freon" refrigerant gas. . . . Designed to be leakproof, the hose is made with a synthetic of a type to prevent permeation by volatile gas. The hose is reinforced with two layers of



braided textile, and is designed to withstand the wide temperature range found on both the suction and discharge sides of the refrigeration compressor. According to the

Fume Removal
NO HEADACHE AT BAYER ASPIRIN PLANT

Photo courtesy of The Bayer Company Division of Sterling Drug, Inc.

In designing the beautiful new Bayer pharmaceutical plant in Trenton, N. J., engineers had to choose the best method of exhausting fumes from the filters. Their prescription: 20 DeBothezat stainless steel Bifurcator Fans installed in ducts right above the filters. Each Bifurcator has a 16" fan wheel with ½ HP motor and exhausts 2450 CFM at ⅜" SP. This method of fume removal protects workmen and equipment and helps maintain the conditions of strict quality control under which Bayer Aspirin is produced.

Choice of Materials — Bifurcators can be constructed of cold rolled steel, stainless steel, rubber coated steel, monel metal and many other corrosion-resistant materials.

Many Sizes — Bifurcators are available in a wide range of sizes and capacities, delivering from 913 cubic feet of air per minute (12" diameter fan with 1/20 HP motor) up to 45,000 cubic feet of air per minute (48" diameter fan with 20 HP motor).

If you have a fume removal problem, investigate DeBothezat Bifurcators. Write or ask your DeBothezat representative for new illustrated catalog. Address Dept. HP-1253.

Here's How **THE BIFURCATOR FAN WORKS . . .**

The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing. Corrosive fumes are by-passed around the motor, which is mounted in a separate chamber, open to atmosphere but isolated from exhaust fumes.

DeBothezat Fans

Division of American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

EQUIPMENT DEVELOPMENTS . . .

[Continued]

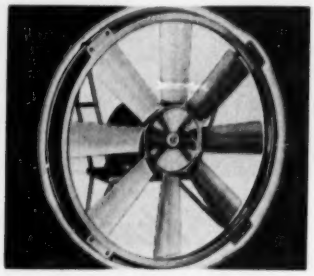
manufacturer, it can be used with working pressures up to 400 psi. It may also be used for carrying lacquers, lacquer solvents, naphtha, kerosene, etc. Inside diameter ranges from ¼ in. to 1 in.

Manufacturer—Quaker Rubber Corp., Div. of H. K. Porter Co., Inc., Comly and Milnor Sts., Philadelphia 24.

High Pressure Fan

New high pressure fan designed to be effective against pressures up to 4 in. . . . .The company states that a new propeller enables this fan to move more air against higher pressure. Featured is a curved orifice air-seal ring said to increase air deliveries 10 percent or more by eliminating backflow of air at the propeller tips. The propeller is made of sand-cast aluminum and the ring and mounting are fabricated of low carbon steel. The fan is available in 28, 36 and 48-in. models.

Manufacturer—Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, Ohio.



Above: Fan
Left: Relay

Time Delay Relay

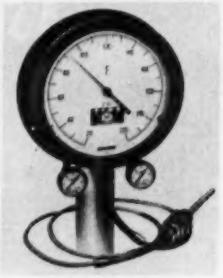
*"Agastat" time delay relay for push-button operation. . . . The "NEH Agastat", pneumatically controlled over a range from 0.1 sec to 10 min, is controlled by the flow of air through an orifice. Air used for timing is recirculated within the timing chamber. The size of the orifice, which determines the length of time delay, is determined by a needle valve adjusted by a screw on top of the timing chamber. The instrument has a normally closed auxiliary hold-in switch. In the de-energized state, the switch contacts are held open by the operating spindle, which is an extension of the solenoid core. The switch is rated 15 amperes at 115 volts, 60-cycle a-c.

Manufacturer—Elastic Stop Nut Corp. of America, A'G'A' Div., Elizabeth, N.J.

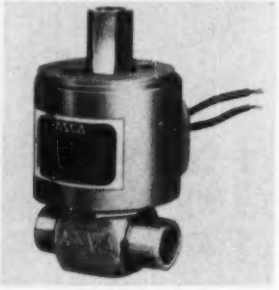
Explosion Proof Solenoid Valves

Line of "Midget" 2-way and 3-way solenoid valves has been expanded to include types with explosion proof solenoids. . . . The manufacturer states that they are suitable for Class 1 Group D hazardous locations. Solenoid enclosures are of cast iron with ½-in. threaded conduit connections. Conduit boxes can be revolved 360 deg. Two-way valves are available normally closed for shutoff, adjustable main flow, and adjustable bypass service, and for normally open shutoff duty. Three-way universal type valves may be applied to any three-way valving requirement regardless of the direction of flow or points of application or pressure, the manufacturer states. Standard voltages for both are 115 or 230 a-c, 60 cycles and 115 volts d-c.

Manufacturer—Automatic Switch Co., 391 Lakeside Ave., Orange, N.J.



Transmitter



Valve

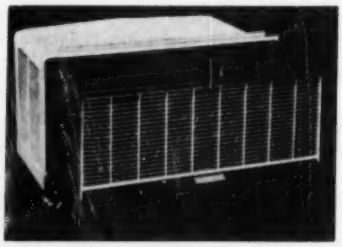
Indicating Temperature Transmitter

Dial thermometer combined with a pneumatic transmitter designed for outdoor unprotected installation. . . . The thermometer utilizes a mercury filled thermal system for temperature ranges from −40 F to 1000 F and a graduated 8-in. diameter scale. The standard air output range of the pneumatic transmitter is said to be 3 to 15 psi. According to the manufacturer, any number of receivers can be operated by a single transmitter so that temperatures may be controlled simultaneously at several locations.

Manufacturer—Penn Industrial Instrument Corp., Penn Bldg., 4110 Haverford Ave., Philadelphia 4.

Room Air Conditioners

Redesigned line of room air conditioners, including models of 1, ¾, ½ and 1/3 hp. . . .The company states that the design changes provide increased cooling and dehumidification and a lower velocity air flow. The ¾ hp size will also be available with reverse cycle operation for heating in cooling weather, employing the principle of the "Weathertron" heat pump. New operating features of the 1, ¾ and ½ hp models include an



exhaust for the removal of smoky or odor-laden air, and a single control for five positions, including a setting for extra dehumidification on muggy days. Three circular louvers, located behind the grille, can be rotated independently. Air intakes on all models are located on the underside of the cabinet.

Manufacturer—General Electric Co., Major Appliance Div., 310 W. Liberty St., Louisville 2, Ky.

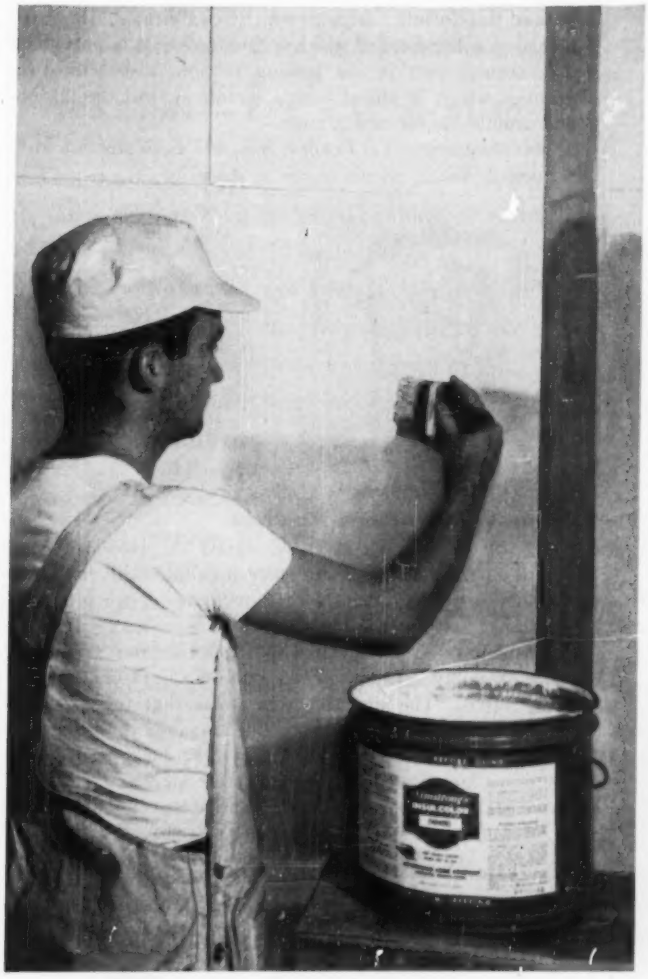
Welding Tip End and Adapter

** New welding tip end and adapter to eliminate the need for replacement of welding tips. . . .

INTRODUCING

Armstrong's Insulcolor

A washable, plastic, cold-room finish that won't crack, shrink, or craze



Now you can have bright, sanitary cold-room interiors that are easy to clean—that stay fresh and attractive year after year! Armstrong's Insulcolor —available in white and seven colors—is a newly developed plastic coating for use in low-temperature rooms. Completely washable, it bonds firmly to portland cement plaster, asphalt emulsion, and bare corkboard surfaces. Low temperatures have no harmful effects on Insulcolor. This finish will hold up as long as the base to which it's applied.

SAFE TO USE. There are no inflammable solvents in Insulcolor, so fire hazard is eliminated during application. Wet or dry, Insulcolor is completely fire-resistant.

EASY TO CLEAN. Dust, dirt, grease, and soot can be readily washed off Insulcolor's smooth surface. A single Insulcolor application lasts many years without recoating.

USE INDOORS OR OUTDOORS. Highly resistant to water and surface damage, Insulcolor can be used over outdoor piping and equipment, as well as in indoor applications.

FOR FREE BOOKLET—describing the use and application of Insulcolor—call your nearest Armstrong office or write to Armstrong Cork Company, 2512 Sherman Street, Lancaster, Pennsylvania.

Easy to Apply. Insulcolor is quickly applied to insulation with either brush or spray gun. On most materials, two coats form a strong, protective film.

INSULCOLOR IS AVAILABLE IN THESE COLORS:
white - dark and light blue - dark and light green - buff - yellow - gray

NEW INSULCOLOR PROTECTS AND IDENTIFIES INSULATED COLD AND HOT LINES, DUCTS, TANKS

Identification of brine, cold-water, steam, and other lines has usually been by stenciled words or painted colors, applied after the finish was dry. Now, with Armstrong's Insulcolor, you get color identification and insulation finish in one application.

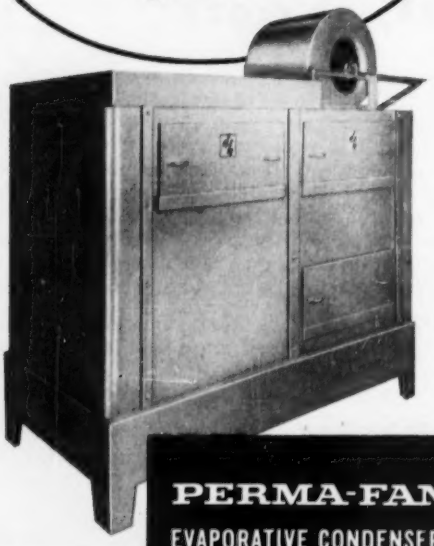
ARMSTRONG'S INSULCOLOR

Born of Experience...

first in 1937 with Blow-Through type evaporative condensers.

PROVED!

BY TROUBLE-FREE PERFORMANCE



PERMA-FAN

EVAPORATIVE CONDENSERS

FIRST to offer a blow-through type evaporative condenser that functioned with continuous, trouble-free performance—DRAYER-HANSON now introduces a newly designed, improved and greatly expanded line of evaporative condensers that utilize the blow-through feature along with design improvements in leak-proof housing construction, hot dip galvanized eliminators, circulating pumps, sump pan drainage and protective finish. In addition, corrosion and scaling of fans are eliminated because of fan location in the supply air stream. These newly designed units are manufactured with the same DRAYER-HANSON craftsmanship and high quality materials that earned the 1937 model a well-founded reputation for continuous and dependable service—even up to this date. Available in sizes ranging from 5 to 60 tons at 78°W.B.

For further information, write for free catalog, or consult your DRAYER-HANSON Agent today!

LONG *established in commercial refrigeration and air conditioning, DRAYER-HANSON offers a complete line of commercial refrigeration and air conditioning products.*

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EQUIPMENT DEVELOPMENTS . . .

[Continued]

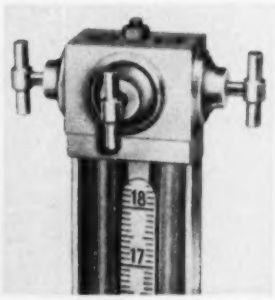
With the use of the "Universal" adapter, which becomes a part of the cutting torch, only the tip end needs to be renewed, the manufacturer states. The cutting tip ends are interchangeable and are said to fit any cutting torch with the use of the adapter.

Manufacturer—The Evans Machine Co., Inc., 122 S. Calverton Rd., Baltimore, Md.

Tube Bender

"TT-55", a lightweight tool to bend tubing, especially hard and soft copper in sizes of 5/8-in. and 7/8-in. O.D. . . . Both bending sizes have the same 3-in. radius. The tool consists of two parts. One is the round base with two grooves to which the hooks are attached to fasten the tubing. The tubing is formed in the grooves around this forming section, which is calibrated. It is attached to a handle, for which a threaded hole is provided. The second part is the pulling section, also with two grooves, which is pulled with a handle against the tubing and around the forming section.

Manufacturer— Tal Bender, Inc., 417 N. Water St., Milwaukee 2, Wis.



Above: Bender

Left: Manifold

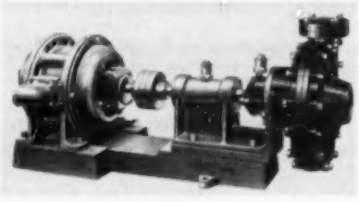
Three-Valve Packless Manifold

"Demi-34" designed to provide a compact and tamperproof three-valve manifold with four connections. . . .When used with a manometer, two pipe connections are required. The other two are sealed between the body and the glass tubes with special rubber grommets. The assembly consists of two shut-off valves and one bypass valve. The manufacturer states that this arrangement reduces the number of connections for three separate valves and fittings from 12 to 2. The body is available in brass, anodized aluminum, steel or stainless steel. All have stainless steel diaphragms and integral seats.

Manufacturer—G. W. Dahl Co., Bristol, R.I.

Corrosion Resistant Pump, Valves, Pipe

Line of corrosion resistant process equipment including centrifugal pumps, valves, pipe and



fittings manufactured in both natural and Buna "N" hard rubber. . . . The pumps are available in two types, one

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Quality

IT TOOK A FLOOD TO KNOCK IT OUT! After 29 years of continuous, trouble-free service in the water supply system of a northern New Jersey Township, this Foster 6" Type U Pressure Regulator was temporarily put out of service by a flash flood. A new Foster Type U Regulator is now on the job, and the old valve, factory overhauled, is now ready for many more years of service.

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Dependable, Trouble-free Service

To give dependable regulation, a valve must be able to meet service requirements without compromise.

There is a specific type of Foster automatic valve for every service need. Each valve is engineered and built to do its job with a comfortable margin to spare, which means low maintenance.

This is the reason that Foster valves, over the years, have established a record for dependable performance second to none.

The next time you need a pressure regulator, it will pay you to tell the Foster Representative your requirements.

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FOSTER ENGINEERING COMPANY · UNION, N. J.

EQUIPMENT DEVELOPMENTS . . .

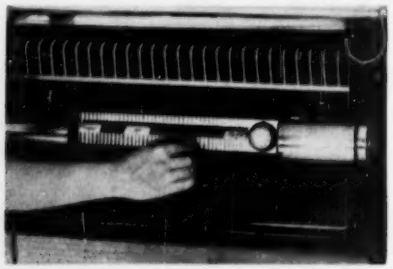
[*Continued*]

having an open impeller and heavy casing, and the other being of lighter construction using a closed impeller. Both pumps utilize a carbon seal to allow for a protective rubber covering of the metal shaft and to eliminate friction and leakage troubles. Pump capacities range from 15 to 100 gpm with discharge heads up to 90 ft of water. Globe, angle and wye valves range in size from 1 in to 4 in. The pipe and pipe fittings range in size from ¼ in. to 4 in.

Manufacturer—Vanton Pump & Equipment Corp., Empire State Bldg., New York 1.

Year-Round Room Air Conditioners

**Three year-round room air conditioners in ½, ¾, and 1 hp sizes. . . . The company, which has just announced its re-entrance to the air conditioning field,

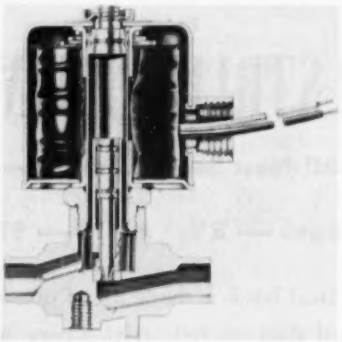


states that the new units deliver six different combinations of cooling, heating and ventilation, selected by adjusting a horizontal glider control. All models are equipped with a thermostat. According to the manufacturer, the design of the cabinets makes possible installing them in any one of 18 positions. The intake and exhaust louvers are located at the back end of the cabinet.

Manufacturer—Amana Refrigeration, Inc., Amana, Iowa.

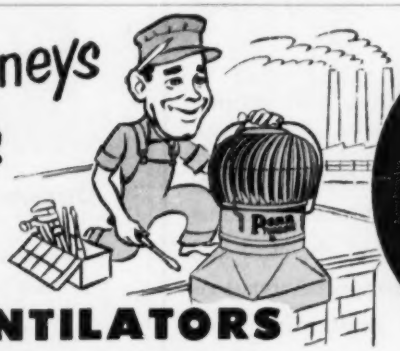
Solenoid Valves

Improved "Model 73" solenoid valves in three orifice sizes — 5/32 in., 3/16 in., and 7/32 in. . . . . The new models incorporate double dipped, varnish-impregnated coils for performance under extreme humidity



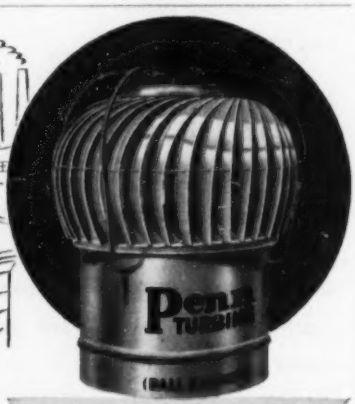
conditions. The coil may be changed to suit voltages required for special application. One feature is an electrical data plate which accompanies each interchangeable coil. When a coil is changed, the new plate is fastened under the coil cover nut so that the identifying data is correct. The coil cover is held with one nut and can be

Cure choked chimneys and faulty flues



with PENN VENTILATORS

Improper draft conditions in chimneys and flues can often be corrected by the use of ventilators. The Penn Turbine and Liberty Siphonage ventilators are two products especially well suited for this application.



PENN TURBINE VENTILATOR

Penn Turbine Ventilators are ruggedly constructed of heavy galvanized steel or copper. They are rust resistant, maintenance-free, automatic. Once installed they require no further attention, care or adjustment.

Liberty® VENTILATOR

All angle wind tests* indicate Ventilator's back-draft control effectiveness. All the air currents — upward, downward, horizontal or swirling are converted into powerful suction forces which accelerate natural drafts in sluggish chimneys. Sizes 6" up.

*United States Testing Co., Inc. Test #E-1532-9/11/50

PENN VENTILATOR COMPANY

Write for complete literature today!

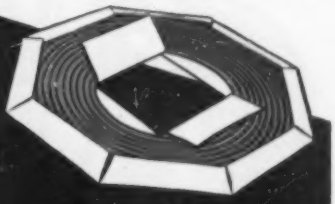
REPRESENTATIVES & DISTRIBUTORS IN PRINCIPAL CITIES

FOR MORE THAN 25 YEARS, THE BUILDERS' ROOF TOP LINE

PHILADELPHIA 40, PA.

NEW "Readi-Pak"*

Another BIG PLUS for READING COPPER TUBE...



- Complete Protection!
- Easier to Handle!

*Copyright Applied For

Reading copper tube . . . produced in America's most modern copper tube mill . . . now comes packed in the industry's most modern container. Individual package is ready for job or re-shipping . . . no half-filled master cartons to hamper inventory. Readi-Pak* stacks or hangs compactly. Contents clearly labeled on sides and edges. Makes a colorful point-of-sale display, too!

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Producers of Reading Lektroneal Copper Tube and Reading 85% Grade A Red Brass Pipe

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Sold Exclusively Through Plumbing & Heating Supply Wholesalers

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Every
RIDGID
Is Work-Tested...
before It Leaves the Factory

...to make sure
it gives you the
Best and the Most
wrench service for your money

The reason RIDGID Heavy-Duty Pipe Wrenches are known for the brutal punishment they can take is because of the toughness built into them, checked part by part and then hard work-tested when assembled...not just one wrench in 100 or 1000 but *every last one!*... Add the guaranteed repair-free housing, no-slip no-lock jaws, handy pipe scale, easy spinning adjustment nut and comfort-grip I-beam handle and you see why genuine RIDGID gives you the big value for your money. Buy them at your Supply House.

THE RIDGE TOOL CO. • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

EQUIPMENT DEVELOPMENTS . . .

[*Continued*]

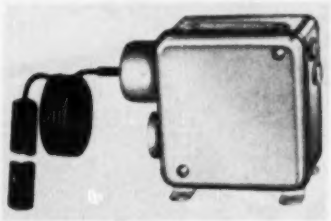
rotated through 360 deg. The valve needle and seat are protected by a removable, noncorrosive screen. The valve is designed for use with noncorrosive liquids and for refrigerants or air.

Manufacturer—A-P Controls Corp., 2460 N. 32nd St., Milwaukee 10, Wis.

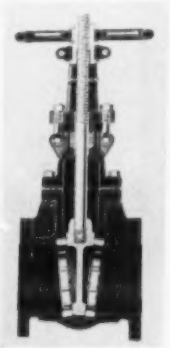
Valve for Mild Corrosion

New 125 lb iron gate valve designed for mildly corrosive service in the process industries. . . . The cast iron body and bonnet of the valve contain 3 percent nickel to provide greater corrosion resistance. The trim is made in 18-8 mo stainless steel or all monel.

Manufacturer—The Lunkenheimer Co., Box 360, Cincinnati 14, Ohio.



Above: Control



Right: Valve

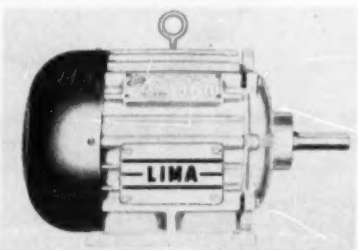
Cooling Tower Control

Cooling tower control for mechanical cooling systems. . . . Designated as the "Type 277BT10," the control is designed for commercial refrigeration and air conditioning service to control evaporative condensers and cooling towers. Temperature range of the control is 50 F to 90 F, with a minimum differential of 4 deg, the company states. When wired in series with the cooling tower fan motor or motor controller, the control is designed to stop the fan when the water temperature falls below the control setting. It may also be used to control the circulating pump where no fan is used.

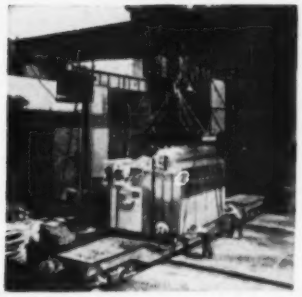
Manufacturer—Penn Controls, Inc. P. O. Box 556, Goshen, Ind.

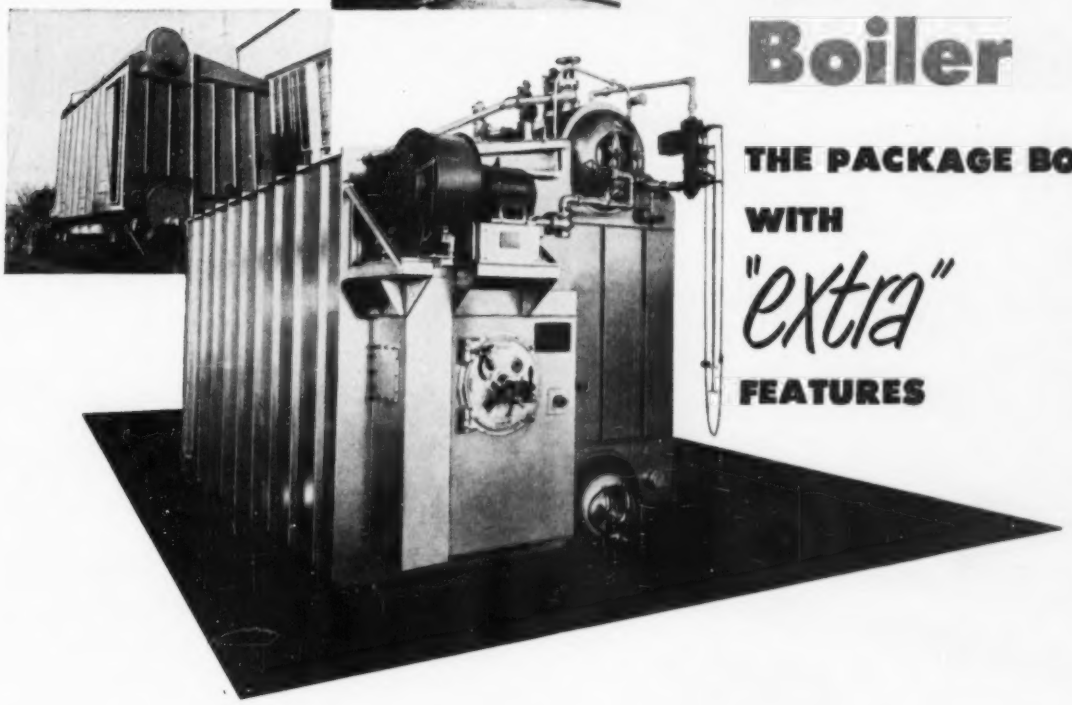
Fan Cooled Motor

New design of a totally enclosed, fan cooled motor. . . . Known as "Type E," it is available in ratings of ¾ hp at 900 rpm to 20 hp at 3600 rpm in



NEMA frame sizes 224 to 326 inclusive. Some of the features include integrally cast fins to provide extra heat dissipating surface, double width prelubricated sealed ball





the VP Boiler

THE PACKAGE BOILER WITH "extra" FEATURES

Most of the water-tube "package" boilers available today look very much alike. As a matter of fact, in some respects they are alike.

The prospective purchaser's job is to discover which of the several package boilers now available offers a combination of features and advantages that adds up to the "best buy".

Consider, then, the fact that the C-E Package Boiler, Type VP, has *all* the design features offered by any of its contemporaries *plus* the important extra features described at the right.

VP Boilers are available in capacities from 4,000 to 30,000 lb of steam per hr; pressures to 250 psi. Send for Bulletin V-15

FULLY WATER-COOLED FURNACE — Even the front or "burner" wall is protected, except in three smallest sizes. Has higher ratio of furnace-wall cooling to furnace volume than any boiler of its size and type. Assures rapid and efficient heat absorption, lower gas temperatures entering convection bank, reduced tendency to slag formation. Minimizes furnace maintenance.

LARGER LOWER DRUM — The large lower drum, 30″ in diameter, permits simple, symmetrical tube arrangement; provides easy access when necessary for washing down or for inspection; greater water storage capacity facilitates handling fluctuating loads.

CENTRIFUGAL FAN — This type of fan is more efficient, operates at lower speed and is quiet in operation. The average noise level is less than half that of typical high-speed blowers used on most boilers of this type. Low noise level is particularly advantageous in confined space and in such installations as hospitals.

SIMPLE BAFFLE ARRANGEMENT — Minimum changes in direction (no baffle at all in convection bank in larger size units). Gives lower draft loss. Simplifies soot blowing. Cross-flow of gas with elimination of dead pockets gives maximum heat pick-up. Water-cooled baffle in intermediate sizes insures minimum maintenance.

B-6528

COMBUSTION ENGINEERING, INC.

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

C-E

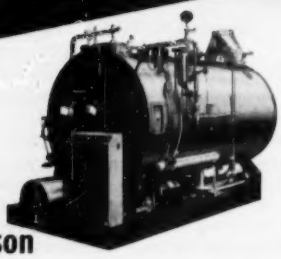
ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

For Tishman Realty & Construction Corporation's record-breaking

99 Park Avenue

On the way from Titusville, Pa. to 99 Park Avenue, N.Y.C. These two large Ticosteam Generators were installed by RAISLER CORPORATION the heating contractors.

TWO TITUSVILLE TICOSTEAM GENERATORS



dependably providing heat for the winter season and summer power for air conditioning

At the heart of New York's most talked-about new building, Tishman's 99 Park Avenue, two modern Titusville Ticosteam package steam generators are on essential duty. Each of these dependable and efficient units has a continuous steam capacity of 15,525 lbs. per hour, peak capacity of 19,300 lbs. per hour, and design pressure of 200 psig. They are fired with heavy oil, using rotary cup burners. ● *Write for TICOSTEAM Bulletin B-3100.*

THE TITUSVILLE IRON WORKS COMPANY

TITUSVILLE, PA.

TITUSVILLE IRON WORKS CO. TITUSVILLE, PA.

A division of Struthers Wells

Manufacturers of

A COMPLETE LINE OF BOILERS FOR EVERY HEATING AND POWER REQUIREMENT

EQUIPMENT DEVELOPMENTS . . .

[Continued]

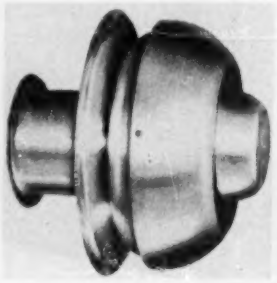
bearings, and a cast aluminum fan designed to provide high velocity air over the cooling fins. According to the manufacturer, the rapid movement of air prevents dirt from accumulating on the motor frame. The motors, 2 or 3 phase, can be supplied for vertical, wall or ceiling mounting, and standard horizontal floor mounting.

Manufacturer—The Lima Electric Motor Co., Dept. 12, Lima, Ohio.

Attachment for Portable Drills

**"E-Z Cut" drill attachment for ¼-in. portable electric drills to form a portable power saw with one hand control. . . .The attachment locks on to the drill housing nose and can be used as a sabre saw for metal, wood, plastic and composition board. The company states that because the drill attachment is locked to the housing, it removes excessive radial stresses from the drill chuck and spindle. Operating on ball bearings, it is installed or removed without special tools or alteration to the drill.

Manufacturer—Jaco Devices Co., 100 High St., Hingham, Mass.



Wall Ventilator

Drill

Blower Ventilators

*Three new spun aluminum blower ventilators all with direct drive. . . . "Model W" wall exhaust ventilator is designed to be adjustable to any wall thickness from 5⅛ in. to 8 in. or to be fitted to a 6-in. or 8-in. duct. The motor is mounted in a separate compartment from the air stream. It is available in 7 in., 9 in. and 10 in. sizes and comes with an automatic back draft damper and intake grilles. The "Model R" roof ventilator is manufactured in 7 in., 9 in. and 10 in. sizes, with a collar to fit over standard 6-in. or 8-in. duct leading to the roof. Largest of the three is "Model BV" with a 9 in., 10 in., 12 in. or 14-in. impeller.

Manufacturer—Loren Cook Co., 644 Front St., Berea, Ohio.

Shielded-Arc Welding Electrode

New electrode, "Jetweld," which incorporates powdered metal in the electrode coating. . . . It is a heavily coated shielded-arc type of electrode for operation in flat or near flat positions with a-c or d-c welding current. Welding speeds typical in lap and fillet work are on the order of 12 to 15 in. per min. The manufacturer states that bead appearance is smooth, that it is virtually splatter free and that it has a stable arc action

MASTER REFERENCE SAMPLE
No. 5 LOW LIMIT Air Flow at 100 psi.
.179 Cu. Ft./Min. at 60°F—30" Hg.
Corrected from
.186 Cu. Ft./Min. at 75°F 30.1" Hg.
O.D. .081 " I. D. .0304 " Length 11'6"
MASTER REFERENCE SAMPLE
No. 1 HIGH LIMIT Air Flow at 100 psi.
.205 Cu. Ft./Min. at 60°F—30" Hg.
Corrected from
.213 Cu. Ft./Min. at 75°F 30.1" Hg.
O.D. .081 " I. D. .0321 " Length 11'6"
QUALITY CAPILLARY TUBES

ANACONDA QUALITY CAPILLARY TUBES:

Now custom-made to specific air-flow limits!

The true quality of every ANACONDA Capillary Tube is measured solely by its performance within specific mutually-agreed-upon air-flow limits. These limits alone are the base for production. ANACONDA Custom-Made Capillary Tube sizes are not confined to so-called standard inside diameters.

(1) To obtain the performance characteristics you require, simply submit your specifications or samples for the class of tube you need, cut if necessary to odd lengths, and *which have the desired limits of air flow.*

(2) From these we can readily determine the required correct nominal inside diameter and the overall tolerance for any given length to possess a flow capacity *within the range of these samples.* An optimum tube size and length may meet your requirements and show a saving in cost.

(3) As illustrated, your initial shipment will contain Master Reference Sample Tubes which have the maximum and minimum flow capacities agreed upon.

(4) Duplicate Master Reference Samples retained in our files are the means for assuring that every tube in all subsequent shipments will have air flow within the agreed-upon limits.

ANACONDA Custom-Made Quality Capillary Tubes are made of both copper and aluminum in nominal inside diameters from .005 in. to .090 in. For detailed information about these finely engineered tubes, write to The French Small Tube Branch, *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.*

5324

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in rotary oil burner sales and installations throughout the world*

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RAY OIL BURNERS

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Again in 1953—as well as for 38 years previous—Ray Oil Burner led the field in sales of horizontal rotary commercial and industrial oil burners.

"Ray has been first from the very first"*

No mere *boast*, this represents the opinion of American industry, an opinion backed up by the hard-boiled dollars of the world's wisest equipment buyers.

To you as a specifier, dealer or user of oil-fired heat, that record stands as an unqualified example of why your choice should be Ray—every time! There is a Ray Burner model to bring to every heat-receiver, Ray principles of efficiency, economy and performance, which have resulted in the record of 39 years of unchallenged sales leadership.

For complete information send for the Ray condensed catalog today!

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EQUIPMENT DEVELOPMENTS . . .

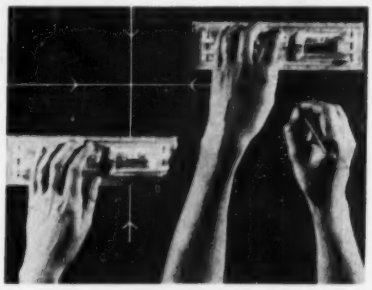
[*Continued*]

resistant to arc blow. The slag produced curls off as it cools. The "Jetweld" is available in 5/32-in., 3/16-in. and ¼-in. sizes.

Manufacturer—The Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17, Ohio.

Portable Drawing Instrument

**Transparent drawing instrument, the "Glide-Rule," capable of rolling in two directions and combining triangles, T-squares, straight edge, scales, protractor and parallel rules. . . . The pocket-size rule has four

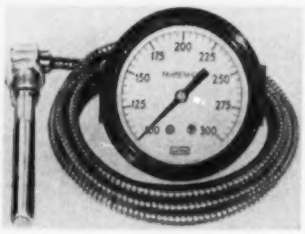


drawing edges with scales in 16ths and 20ths. The instrument rolls both up and down and right and left leaving one hand free for drawing. A small thumb button permits the user to change direction.

Manufacturer—Smith Drake Corp., 1206 S. La Brea Ave., Inglewood, Calif.

Small Mercury Dial Thermometer

Miniature mercury actuated dial thermometer designed for application when panel or mounting space limitations prevent the use of larger dials. . . .The dial is 2½ in. in diameter and the bulb is approximately half the length of a standard size bulb. The thermometers



have a stainless steel thermal system and bronze movement. The movement is enclosed in a drawn steel case, equipped with a U-shaped clamp for panel mounting.

Manufacturer—United States Gauge, Div. of American Machine and Metals, Inc., Dept. MM, Sellersville, Pa.

Gas Fired Unit Heater

Ceiling suspended gas fired unit heater which operates independently of a central system heating plant. . . .Electrical, gas and flue connections are needed to put it into operation. Natural, manufactured or liquefied petroleum gases may be used. Heat exchanger tubes are constructed of corrosion resisting aluminized steel and are designed to give maximum heat transfer with a minimum resistance to air flow, the company states. Seven

EQUIPMENT DEVELOPMENTS . . .

[Continued]

sizes provide a range of capacities from 25,000 to 200,000 Btu's per hr.

Manufacturer—Westinghouse Electric Corp., Air Conditioning Div., Dept. T-401, 200 Readville St., Hyde Park, Boston 30, Mass.

Corrosion Resistant Filter

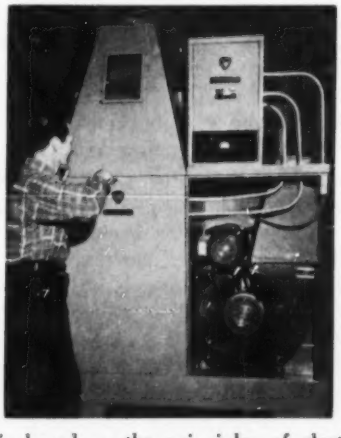
**Filters designed to be resistant to highly corrosive materials such as fuming nitric acid, hydrogen peroxide and hydrochloric acid. . . . The filter medium is porous "Kel-F" which, the manufacturer states, is resistant to all common acids and gases in all concentrations, as well as to common organic chemicals. Accord-

ing to the company, the filter element will remove particles larger than five microns in liquid filtration and finer particles in gas filtration, can be used at temperatures up to 350 F and is resistant to thermal shock. It has a tensile strength of 900 psi and a modulus of elasticity of 18,000 psi.

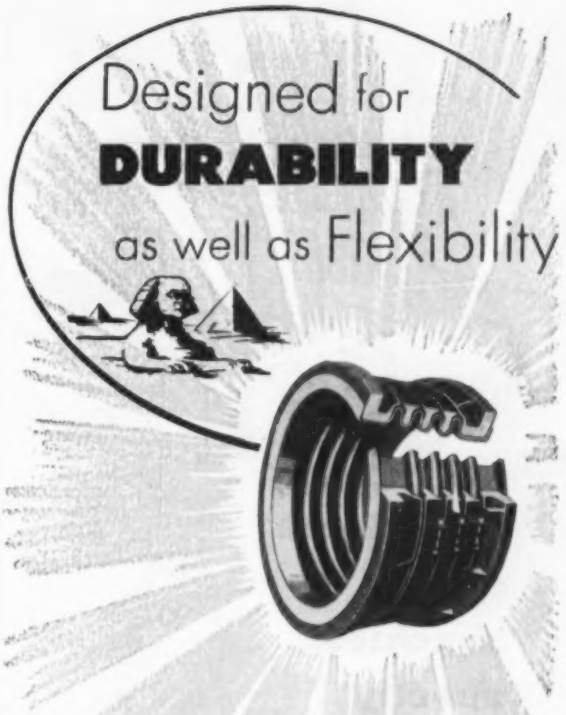
Manufacturer—Porous Plastic Filter Co., Glen Cove, N.Y.

Oil Smoke Precipitator

Electronic oil smoke precipitator for collecting oil mist and oil smoke generated from high speed cutting and grinding operations. . . .Operation of the

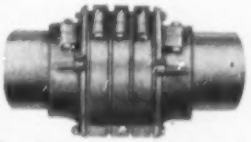


equipment is based on the principles of electrostatic attraction. Particles are drawn through the ductwork to the precipitator and receive a high voltage positive electrical charge. The particles are then attracted and adhere



DURABILITY is designed into the Badger Directed-Flexing, Self-Equalizing Joints:

1. each corrugation is designed with the proper depth for its diameter; each diameter is gauged to its proper traverse.
2. each corrugation—and it's the Badger *all curve* corrugation—is shaped to flex by Directed Flexing using matching shaped equalizing rings to guide and control the flexing movement. The corrugation wraps and unwraps itself, using the rings as the bearing surface, distributing the flexing stresses evenly over all areas of each of the all-curve corrugations.
3. each corrugation is progressively controlled and limited to its proper flexing traverse.
4. the corrugations are formed from a single metal tube of suitable length by a special forming process which minimizes forming stresses in the metal.
5. every joint is scientifically heat-treated at each of several key steps in its manufacture.



The many thousands of Badger Directed-Flexing, Self-Equalizing Expansion Joints in service now for many years are in themselves testimonials as to their durability. They will serve you equally well. With a wide range of sizes in either flanged or welding end design, with a choice of several metals, with facilities for designing special joints, why not let our expansion joint specialists take care of your requirements?

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

Shed those design shackles, specify

AGITAIR

You can give free rein to your creative planning and still rely on AGITAIR square and rectangular diffusers to provide draftless air distribution from any location. Custom-designed, with built-in diffusing vanes, in a wide variety of louvered patterns, they provide blows in 1, 2, 3 or 4 directions without use of blank-offs. AGITAIR diffusers need not be centrally located in an area if such placing does not agree with the decorative motif, or if a beam or other obstruction is in the way.

Moreover, AGITAIR square and rectangular diffusers are now available with or without removable, interchangeable cores. AGITAIR also brings you Stripline, the slender, continuous air diffuser with unlimited application versatility.

New 34-page Type R Catalog reveals how correct air distribution is simplified by AGITAIR. Contact your local AGITAIR representative, or write us direct for your free copy.

AIR DEVICES INC.
185 Madison Avenue, New York 16, N. Y.

AIR DIFFUSERS • FILTERS • EXHAUSTERS

EQUIPMENT DEVELOPMENTS . . .

[Continued]

to collecting plates of negative polarity. A buildup of material on these plates is said to be avoided by fogging coolant oil directly into the air stream ahead of the precipitator. The collecting plates are coated with oil so that the smoke deposit and the oil flow together into a drain pan and back to the machine reservoir.

Manufacturer—Trion, Inc., 1000 Island Ave., McKees Rocks, Pa.

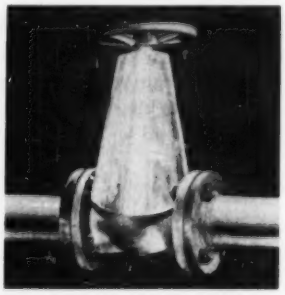
Axial Flow Fans

**Nine new models of axial flow fans in sizes 12 in. through 60 in. with capacities to 80,000 cfm. . . . According to the manufacturer, this line includes fans for most industrial and commercial air handling applications. Some of the features include access doors for maintenance, motors installed inside or outside units as desired and are welded joints for a weather tight seal. Roof units are made to conform with roof pitches and architectural appearance.

Manufacturer—Kody Blower Co., Trenton, N. J.

Plastic Valve Bonnet Shield

Transparent plastic valve bonnet shield to provide visual detection of leaks. . . .Made of polyethelene plastic, the "Wilplac" is said to withstand most acid



and corrosive conditions. The shield is installed on the valve without removing the handwheel and is said to be reusable and transferrable.

Manufacturer—Wilmington Plastics Inc., 810 S. Heald St., Wilmington, Del.

Room Air Conditioners

*Return of this manufacturer to the room air conditioner field after an 11-year absence. . . . There are five models in the new line, ranging from ½ to 1½ hp. According to the manufacturer, pushbutton controls in the three "Deluxe" models provide a choice of ten zones, while dial-type controls on the two "Special" models have six settings. All are equipped with adjustable grilles. Heating elements are built into the ¾ and 1 hp Deluxe models and thermostats are standard equipment on these models. Controls are concealed beneath the cabinet lid. The company also is introducing its 1954 line of dehumidifiers, one of which also doubles as a room heater.

Manufacturer—Westinghouse Electric Corp., Box 868, Pittsburgh 30, Pa.

RECENT TRADE LITERATURE..

Air Conditioning Control Equipment

Brochure illustrates and describes equipment for air conditioning such as unified controls, increment and reduced voltage starters, manual starters, combination starters, distribution equipment and accessories such as control relays and pressure and float switches. Included are applications and photographs of each piece of equipment.

Manufacturer—The Square D Co., 6060 Rivard St., Detroit 11.

Air Vents

Check chart ready for mounting which illustrates and describes the company's line of automatic air vents for hot water heating systems. The chart shows the application of the air valves, together with repair parts for each valve.

Manufacturer—Maid-O'-Mist, Inc., 3217 N. Pulaski Rd., Chicago 41.

Aluminum Pipe Insulation

A new bulletin, *Aluminum-Jacketed Foamglas Pipe Insulation*, has been prepared. The bulletin points out the features of the aluminum wrapped-at-the-factory cellular glass insulation. Illustrated condensed specifications for the insulation of both hot and cold lines are presented.

Manufacturer—Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22, Pa.

Automatic Heating Controls

Condensed catalog contains information on specifications, applications and engineering data for automatic heating controls for oil, gas or coal systems. New products described include a newly-designed horizontal low voltage heating thermostat and a short shank warm air furnace control for mounting directly on the furnace casing.

Manufacturer—Penn Controls, Inc., Box 556, Goshen, Ind.

Baseboard Heating

Bulletin B-1602 describes and illustrates the various components of the manufacturer's baseboard heating design which has 37 percent fewer parts than the earlier model. The new bulletin gives complete technical data and IBR approved ratings.

Manufacturer—Warren Webster & Co., 1664 Federal St., Camden, N.J.

Boilers for Replacement

Illustrated catalog describes steel water-tube boilers for replacement. According to the manufacturer, these low pressure heating boilers are built primarily for replacement because all parts can be carried through any door or stairway and erected in present boiler rooms without building breakage. Tables showing complete specifications and engineering data are included.

Manufacturer—William C. Zingheim Co., Delta Steel Boiler Div., 5050 Lake St., Chicago 44.

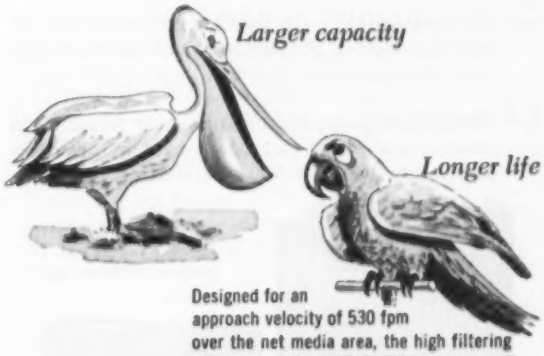
For highest filtering efficiency wise birds select AGITAIR FM AIR FILTERS

High velocity...utmost efficiency

One-third less space required

Lowest installation and maintenance costs

Larger capacity



Longer life

Designed for an approach velocity of 530 fpm over the net media area, the high filtering efficiency of the AGITAIR FM increases as the dust load is applied. You save ⅓ in space required, in number of units to be installed and serviced. Very large dust-holding capacity of AGITAIR FM assures longer service periods, fewer cleanings per year, lower service charges. No exposed wire ends to cut or damage hands of service operators. Compare.

AGITAIR FM

Send today for free Cost Comparison Chart.

AIR DEVICES INC.
185 Madison Avenue, New York 16, N. Y.

FILTERS • AIR DIFFUSERS • EXHAUSTERS

CLEVELAND DRAFT CONTROL SYSTEMS ARE UL LISTED

Here is what this means to you— When you specify, install or use CLEVELAND (patented) Sequence Draft Control Systems, you can now have the assurance that both the control and operating units have been tested and listed by Underwriters' Laboratories, Inc., for the following:

SAFETY—Interlocks with combustion safety controls for safe, dependable operation of control system with the resulting safety of boiler operation.

DESIGN—Correct mechanical and electrical engineering, with proper materials and construction.

ACCURACY OF PERFORMANCE—Sensitivity of instruments to variations in overfire draft and correct electrical and mechanical linkage to provide accurate automatic control within strict tolerance limits.

DEPENDABILITY OF OPERATION—Proven by extreme tests to provide adequate safety factors for all conditions.

ENDURANCE—Separate components passed rigid endurance tests. Complete system performs accurately after 100,000 operations.

Model DCR-CL
Draft Control and
"Lectricarm" Drive Unit

Only ***CLEVELAND DAMPER CONTROL*** *has the* ***ADJUSTABLE START FEATURE*** *for induced draft systems*

Write for complete information

The CFE line includes damper controls, steam controls, electronic smoke detector control units, draft, air pressure and flue temperature gages.

COMBUSTION CONTROLS — Cleveland Fuel Equipment Co. — Cleveland, Ohio

CLEVELAND *fuel Equipment* **COMPANY**

1111 BROOKPARK RD. • CLEVELAND, OHIO

RECENT TRADE LITERATURE . . .

[Continued]

Brass and Copper Fittings

Simplification in the listing of types and sizes of fittings is the company's aim in its new Catalog 300. The booklet covers a wide line of tube fittings, valves, cocks, tubing tools and specialty accessories. All products are illustrated in color.

Manufacturer—Anderson Metals Corp., Overland Park, Kansas.

Capillary Tubes and Strainers

Series of charts show new line of capillary tube and strainer combinations for commercial refrigeration. The charts show the different sizes for low, medium and high back pressure applications. The charts also show how to purchase capillary tubes from 1/8 hp to 1 hp for "Freon-22" and "Freon-12" refrigerants.

Manufacturer—Sealed Unit Parts Co., Inc., 261 E. 161st St., New York 51.

Combustion Control

Bulletin C-101 describes and illustrates automatic combustion controls such as a master regulator, loading transmitter, air flow regulator, draft regulator and a sequence draft regulator. Featured is a packaged metered control unit which was designed for the larger sizes of pressure fired water tube factory assembled boilers.

Manufacturer—Reliance Instrument Mfg. Corp., 190 Glen Cove Ave., Glen Cove, L.I., N.Y.

Cooling Water Treatment

Instrumentation data sheet No. 9.6-7 describes the automatically controlled feeding of sulfuric acid and sodium dichromate and the continuous regulation of blow down using recording and indicating "ElectroniK" potentiometer with "Air-O-Line" control. A resume of the problems inherent with recirculated cooling water systems is given along with a detailed description of the necessary instrumentation.

Manufacturer—Minneapolis-Honeywell Regulator Co., Industrial Div., Station 64, Wayne and Windrim Aves., Philadelphia 44.

Electronic Controls

Catalog F 6166 describes the company's line of electronic controls for heating, ventilating and air conditioning. Descriptive information concerning the sensitive micro relay designed to simplify the amplifier also is included. A complete description of the various elements required for system application is given.

Manufacturer—Barber-Colman Co., 1228 Rock St., Rockford, Ill.

Glass Insulation for Pipes

Recently released is a new four-page folder, *Foamglas, the Long-Life, All-Temperature Pipe Insulation.* The folder features on-the-job installation photographs showing the uses of cellular glass insulation for pipe temperatures between −300 F and 800 F. Also included is a complete listing of the physical properties of "Foamglas" and condensed recommended specifications.

Manufacturer—Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22, Pa.

RECENT TRADE LITERATURE . . .

[*Continued*]

Hardfacing Methods

Selection and Evaluation of Methods of Hardfacing, a reprint of an article. The major methods employed in the application of hardfacing materials are discussed, with special emphasis on the inert-gas-shielded arc process. Twenty illustrations include photographs of overlay specimens and photomicrographs of deposits.

Copies of the reprint are available from the Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 60 E. 42nd St., New York 17.

Heat Transfer Method

All Your Questions Are Answered By Cyclotherm is a new pamphlet explaining this company's patented method of "Cyclonic Combustion." Descriptive drawings show how air is introduced into the combustion chamber at extremely high speeds in a revolving spiral vortex, transferring heat to the fire tubes by direct radiation and convection. The booklet also explains how company engineers have cut down the necessary heating surface to 3 sq ft per boiler horsepower.

Manufacturer—Cyclotherm Div., United States Radiator Corp., 157 E. First St., Oswego, N.Y.

Heating and Power Equipment

Catalog 3048 is a general catalog of commercial-industrial automatic heating and power equipment. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included. Specifications and detailed data on exclusive features of the firm's oil, gas and combination oil-gas burners are given.

Manufacturer—Petro, 3170 W. 106th St., Cleveland 11, Ohio.

Heating System Controls

Series of three bulletins describes the operation and application of the "Weather-Flo" indoor-outdoor building heat controller. Bulletin E-353 describes the operation and results of "Weather-Flo." Bulletin F-453 describes its application to hot water systems and Bulletin H-653 describes its application to warm air systems.

Manufacturer—Automatic Devices Co., Inc., Western Springs, Ill.

Humidity Conditioning

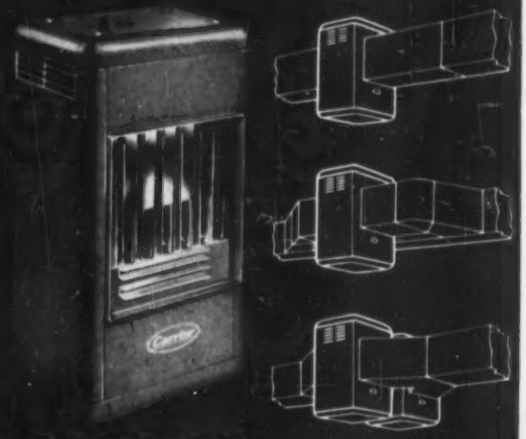
The applications of humidity conditioning to the packaging materials and foundry cupola fields are presented in a new issue of *The Humidity Engineer*. One of the articles is a case history dealing with the solution of the problem of the deterioration of packing materials, such as cellophane, while in storge or during processing, due to exposure to extremes of temperature and humidity.

Published by—Surface Combustion Corp., 2375 Dorr St., Toledo 1, Ohio.

Keys and Switches

Keys and Switches, a new 12-page catalog, describes how they are being used to connect into low

VERSATILITY
WIDENS ITS FIELD



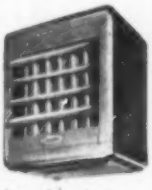
CARRIER ENGINEERING
SPEEDS ITS SALE

The commercial and industrial uses of the Carrier Gas-fired Duct-type Unit Heater are vast and varied. It affords ready application—singly or in parallel—to all types of forced air duct systems (including bypass to cooling systems). It provides controlled heat intermittently or continuously, as desired. Carrier engineered design, fabrication, operating efficiency and installation facility make it an easy first-choice.

Heart of the Unit is its *16*-gauge ALUMINIZED STEEL heat exchanger solidly welded to a rugged combustion chamber of the same material—an *exclusive* Carrier feature. This makes a one-piece gas-tight assembly that resists corrosion, withstands extreme heat and assures much longer life than heavier gauge furnace steel. AGA-approved for all gases. Seven sizes, from 70,000 to 230,000 Btu's.

For further information about Carrier Gas-Fired Unit Heaters, write to Carrier Corporation, Syracuse, New York

Carrier Gas-fired, Propeller-type Unit Heaters *(left)* have the same ratings and fundamental features as the Duct-type. Now also made in a new, compact model *(right)* for low ceiling installations. Omits combustion chamber by firing gas directly in tubes of heat exchanger. Capacity: 50,000 Btu's.

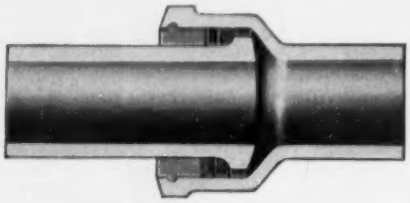


Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

Just remember that

Duriron Acidproof Drain Pipe



is installed by ordinary plumbing methods and

resists corrosion throughout the entire thickness of the pipe wall

Duriron, a high silicon iron alloy, is extremely resistant to most industrial and commercial corrosives—and resists abrasion and erosion, too. This resistance is not just "skin deep," but exists throughout the entire thickness of the pipe wall. That's why Duriron can be expected to outlast the building in which it is installed. Duriron pipe and fittings are available from stock in principal cities. Free Bulletin PF/4 gives complete details.

THE DURIRON COMPANY, Inc.

DURIRON
LOOK FOR THE NAME ON EVERY PIECE

404 North Findlay St.
DAYTON 1, OHIO

RECENT TRADE LITERATURE . . .

[*Continued*]

voltage circuits thermocouples, conductivity cells, batteries, galvanometers or other two or three-lead elements. Included are photographs and line drawings illustrating design features. Dimensions and mounting directions are given.

Manufacturer—Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44.

LP Gas Valves

New brochure on LP-gas valves contains construction details, basic specifications and valve applications for the bronze globe, angle, check, spring-loaded check and gate valves. According to the company, the valves are recommended for all common commercial forms of liquefied petroleum gases whether handled in liquid or gaseous state and are designed for application on all types of piping systems for storing, transporting and utilizing these gases.

Manufacturer—The Fairbanks Co., LP-Gas, 393 Lafayette St., New York 3.

Motor Control

The *ABC of Large A-C Motor Control* is a 36-page special issue of the *E-M Synchronizer* presenting facts helpful in the proper selection and application of controls for large industrial motors. The booklet contains more than 60 illustrations and charts. In addition to describing the various control arrangements available for large motor applications the booklet includes discussions of the latest developments in motor and personnel protective features.

Manufacturer—Electric Machinery Mfg. Co., 1331 Tyler St., N.E., Minneapolis 13, Minn.

New Motor Line

This manufacturer's recently announced line of "Tri-Clad 55" motors, built in 1 to 30 hp ratings to latest NEMA dimensions, are described in three new four-color picture-story bulletins. The publications contain complete descriptions of new maintenance, performance, and protective features of the line, and each includes a double spread cutaway drawing of the motors. Booklet GEA-6013 covers dripproof models; GEA-6012 covers enclosed motors; GEA-6027 describes new gear motors.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

Oil Burners

Sixteen-page catalog No. 5052 describes horizontal rotary oil burners, combination oil-gas burners, and forced draft packaged burners for oil and combination oil-gas firing. Illustrations and text cover features of the burners, including "Oil Volumeter," prewired control panels, ignition system, oil pre-heating apparatus, and forced draft equipment. The catalog contains numerous cutaway illustrations and data on models and capacities.

Manufacturer—Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland 11, Ohio.

Oil Fired Space Heater

Case Study No. 560-56 describes how a metal fabricating shop saved two-thirds the cost of a con-

RECENT TRADE LITERATURE . . .

[*Continued*]

ventional heating system by using oil-fired, warm air space heaters. The four-page folder explains the reasons for the saving, the economics of operation, and the amount of floor space recovered for manufacturing when the new system was installed.

Manufacturer—Dravo Corp., 1203 Dravo Bldg., Pittsburgh 22, Pa.

Perforated Metals and Grilles

Catalog 39 on perforated metals illustrates and describes the line of round, square, oblong and ornamental perforations, ranging from .02 in. to 9.5 in. in diameter. The booklet gives hole sizes, open areas, gage limits and other information for engineers and designers. Also illustrated are modern industrial, architectural and ornamental applications, including grilles.

Manufacturer—Diamond Mfg. Co., 253 W. Eighth St., Wyoming, Pa.

Plastic Pipe

New catalog describes the firm's line of semi-rigid and flexible plastic pipe, shows how to join plastic pipe, and lists various corrosion and engineering data. Advantages and applications are given in the booklet.

Manufacturer—Republic Steel Corp., Adv. Div., 3100 E. 45th St., Cleveland 27, Ohio.

Platform Lift for Maintenance Work

Brochure describes the "Lift-A-Loft," a high lift electric truck for maintenance men doing overhead work. The truck can be moved from job to job carrying with it tools and supplies. The platform rises to a height of 20 ft. All movements are controlled by push-buttons. The booklet describes the operation of the truck and shows all component parts.

Manufacturer—Barrett-Cravens Co., 4609 S. Western Blvd., Chicago 9.

Pressure Equipment

Catalog 400 presents size and pressure tables and technical data on separators, exhaust heads, traps and strainers and boiler trimmings. Each type of equipment is illustrated. Requests for copies should be addressed on company letterhead.

Manufacturer—Wright-Austin Co., 3245 Wight St., Detroit 7.

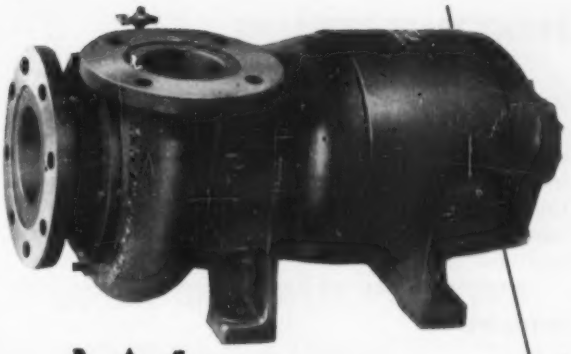
Product Listing for Tubing

Statement of Scope is a 12-page, pocket-sized booklet intended as a complete reference to the manufacturer's tube products, the range of sizes, lengths and tempers. Also featured are listings of individual product literature available and locations of sales offices and plants.

Manufacturer—Wolverine Tube Div. of Calumet & Hecla Bldg., 1419 Central Ave., Detroit 9.

Propeller Fans

Thirteen types of fans are shown in Bulletin A-109. Three new additions to the company's line which are included are a panel fan, a high pressure fan and a direct-drive "Lo-Noise" fan. The bulletin also describes three types of roof ventilators, unit heaters and

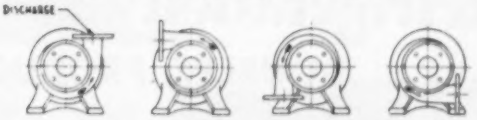


WEINMAN
Close
Coupled
Centrifugal
Pumps

lower in first cost, lower in maintenance cost!

Installation of air conditioning systems is sometimes a tricky business. Space in existing buildings is usually limited, making pump replacement a real problem. WEINMAN close coupled centrifugal pumps are designed to lick this problem, and here's the way they do it:

WEINMAN pumps require less space to begin with. They can be mounted in any position. Note, too, that the discharge can be turned to any one of four different positions.



This means you can mount a WEINMAN pump on the wall, suspend it from the ceiling, bottom or side of a tank, or on the floor . . . important where installation space is limited.

If pumps are a problem that's plaguing your installations, call a WEINMAN Centrifugal Pump Specialist. He has the solution and the pumps, to solve the toughest jobs.

"Centrifugal Specialists"
The WEINMAN Pump Mfg. Co.
296 Spruce St. Columbus 8, Ohio

RECENT TRADE LITERATURE . . .

[Continued]

intake air units. Included also are specifications, dimensions and performance figures plus engineering data. A special feature is a discussion of corrosion-resistant materials and coatings which includes a table showing the suitability of special materials and coatings for use in a wide variety of fumes commonly encountered in industrial applications.

Manufacturer—Hartzell Propeller Fan Co., Piqua, Ohio.

Refrigerants

Technical Service Bulletin describes "Genetron" refrigerants, trichloromonofluoromethane and dichlorodifluoromethane. Included are physical data and quality specifications and graphs showing saturated liquid and vapor density, saturated liquid and vapor heat content, and vapor pressure.

Manufacturer—General Chemical Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6.

Safety Devices for Boilers and Tanks

New edition of a condensed catalog and price list of safety devices for steam and hot water boilers and hot water tanks has recently been released. It is designed to give contractors and wholesalers information on the firm's boiler feeders, low water cutoffs, pump controls, and pressure and temperature relief valves. One feature is the service recommendation chart for selecting the proper control within each of the four major job classifications covered. Included for the first time is information on the use of safety water feeders on hot water boilers.

Manufacturer—McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18.

Sewage and Sump Pumps

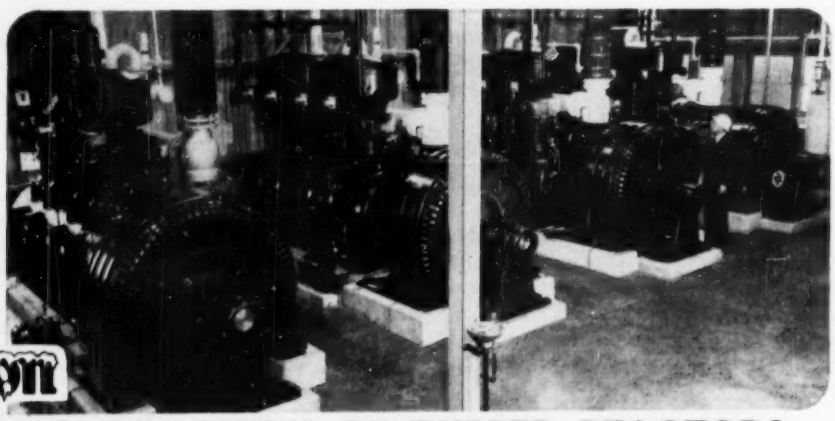
Bulletin No. 325-A 22 describes vertical wet pit single or duplex pumps, vertical dry pit and horizontal models. Complete specifications are given for all types and optional equipment is illustrated and explained. Performance tables are supplied according to pump capacity and detailed selection charts are included. Dimension drawings are shown to help in preparing engineering layouts.

Manufacturer—American-Marsh Pumps, Inc., 60 Capital Ave., N.E., Battle Creek, Mich.

Welding Fittings, Pipe and Tubing

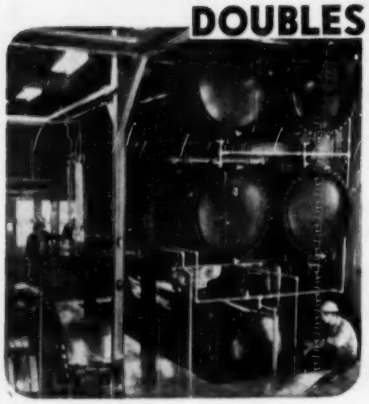
New catalog covers the manufacturer's line of large diameter, corrosion resistant pipe, tubing and welding fittings. Sections on special metals and alloys, grades and finishes, size and length tables, weight tables, standard tolerances and dimensional charts are included. Another book available is *Engineering Data Tables*. Subjects cover corrosion resistance of nickel alloys, chemical and physical properties of alloys, pipe flow data, fluid-flow-friction losses, beam formulas, ASTM specifications, mitered elbow dimensions and bolt strength.

Manufacturer—Stainless Welded Products, Inc., 251 Cornelison Ave., Jersey City 2, N.J.



FRICK TRADE MARK Refrigeration

DOUBLES PRODUCTION OF RUBBER REACTORS



Synthetic rubber plants all over this country, and in Canada, are finding Frick special coils and controls the answer to the problem of cooling reactors. Vertical pipes flooded with ammonia, inside the reactors, replace sluggish brine jackets with trigger-fast cooling. This exclusive Frick development cuts reactor time in half—an unbelievable achievement!

What is YOUR cooling problem? Whether for process work, research, air conditioning, cold storage, or quick freezing, there's a Frick refrigerating system to suit your needs. Let us submit estimates now on your requirements. Branches and Distributors in principal cities: write, wire, phone or visit

Photos show Frick Ammonia Compressors, with 600-hp. motors; Frick Condensers, Receivers and Purger at Kentucky Synthetic Rubber Corp., Louisville, Ky.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

WE HEAR THAT . . .

W. M. REED, president of the *AMERICAN AIR FILTER CO.*, has announced the purchase of *ILLINOIS ENGINEERING CO.*, Chicago, effective November 2. The Chicago firm, which will become a wholly-owned subsidiary of American Air Filter, manufactures a line of valves, traps, expansion joints and steam control systems.

Mr. Reed pointed out that the Illinois Engineering firm was acquired by exchange of 28,500 shares of AAF common stock for all 24,500 shares of common stock of the Illinois firm.

The new subsidiary, which was founded in 1900, had sales of slightly less than one million dollars during the past year.

American Air Filter, with home offices and four plants in Louisville, Ky. for the manufacture of air filter and dust control equipment, also operates two plants at its Herman Nelson Div. in Moline, Ill. The Herman Nelson products include heating and ventilating equipment for the commercial, industrial and institutional markets.

In the announcement, Mr. Reed stated that Illinois Engineering will continue to make and distribute steam and fluid control equipment with its present personnel and facilities.

Recently the *POWER FAN MANUFACTURERS' ASSOCIATION* was formed with the purpose of establishing accurate delivery ratings for fans and ventilators. Formerly the Propeller Fan Manufacturers' Association, the new organization is a consolidation with 12 power roof ventilator manufacturers. The new association now has 34 members whose products cover axial fans, propeller fans, power roof ventilators, window, kitchen and attic fans. Offices are at 2159 Guardian Bldg., Detroit 26.

The *HEATING, PIPING and AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION* has announced the adoption of a new three-color seal to become the official symbol of the group. Set upon a black background, the circular symbol shows the capitals "H", "P" and "A", representing heating, piping and air conditioning. The letter "H" is half covered with fiery red flames, the second letter is composed of two sections of pipe bent to form a "P", and the letter "A" is set off in cold blue, topped with ice. The full title of the association forms a perimeter in the shape of a "C" circling the word "Contractors", in red, which is placed under "HPA".

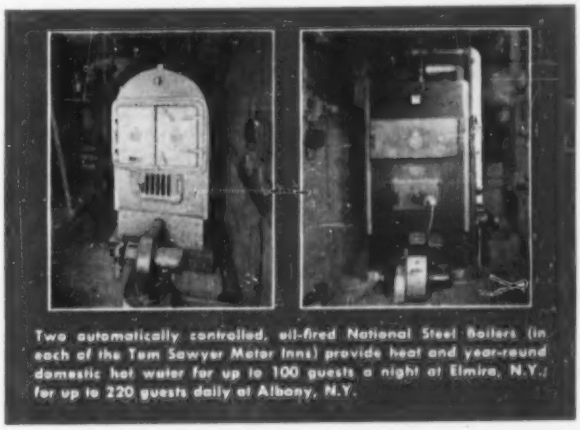
WORTHINGTON CORP. recently was awarded the "Oscar of Industry" trophy for the best corporation annual report of the year in the air conditioning industry. The award was made by *Financial World*, sponsor of the contest. At the same time it was announced that the award for the best annual report in the "stove and heater" industry was won by *BELL & GOSSETT CO.*

A. O. SMITH CORP. recently opened the new Eastern Welding Electrode Plant at Lancaster, Pa. The plant contains many unique features to provide ideal conditions for the manufacture of welding electrodes. To bar dust

NATIONAL STEEL BOILERS

Source of year-round comfort for guests of TOM SAWYER MOTOR INNS

Twin combination National hot water central heating plants are the heart of one of the most modern and well-engineered motel installations in the country today.



Two automatically controlled, oil-fired National Steel Boilers (in each of the Tom Sawyer Motor Inns) provide heat and year-round domestic hot water for up to 100 guests a night at Elmira, N.Y.; for up to 220 guests daily at Albany, N.Y.

"Not a cent for maintenance . . . no trouble . . . reasonable fuel bills," says Col. James P. Schwartz, President

These boilers have been in continuous operation with no maintenance cost for five years at Elmira . . . and since 1951 at Albany.

SERVE DUAL PURPOSE

The National Boilers provide hot water for circulating through radiant panels for heating comfort . . . and also supply domestic hot water for guest use.

For further information on National Steel Boilers, ask for Bulletins 506, 507, 527-HP-12.

Complete Heating for Homes, Commercial Buildings and Industry since 1894.

Architect: Benjamin A. Crowther, Elmira, N. Y. *General Contractor:* Decker Construction Corp., Elmira, N. Y. *Wholesaler:* LeValley, MacLeod, Inc., Elmira, N. Y. *Heating Contractors*—Albany: A. J. Eckert Co.; Elmira: C. R. Evans Corp.

THE NATIONAL RADIATOR COMPANY
JOHNSTOWN, PA.

for Real Heating Comfort go NATIONAL

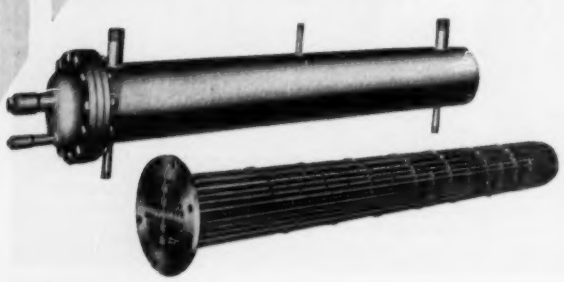
BRANCH OFFICES:
BALTIMORE • BOSTON • BUFFALO
CHICAGO • CLEVELAND • DETROIT
NEW YORK • PHILADELPHIA
PITTSBURGH • RICHMOND • SAN FRANCISCO • WASHINGTON, D.C.

BETTER COOLING WITH

Taco

"CONTROLLED VELOCITY" CHILLERS

1. Improved heat transfer
2. Rapid response to Thermal Expansion Valve
3. No oil logging and slop over



Because . . .

TACO'S "CONTROLLED VELOCITY" TUBE BUNDLES

Carry *all* incoming liquid to the top of the Chiller in the first pass.

Provide constant forward movement of *all* refrigerant and oil.

Prevent accumulation of liquid (refrigerant or oil) in any part of the Chiller.

And because . . .

TACO'S "CONTROLLED VELOCITY" HEADS . . .

Agitate oil and liquid refrigerant, at each head pass, with a constant stream of expanding gas.

Provide unretarded flow of refrigerant.

Eliminate "traps" for oil and liquid refrigerant

For full information and Taco's "pin-point" Selection Charts, write for Bulletin CWF.

Taco

TACO HEATERS INCORPORATED
137 South Street Providence 3, R. I.

WE HEAR THAT . . .

[*Continued*]

and dirt from manufacturing operations the building has no windows or skylights. A system of air pressure balancing, where slightly more outside air is admitted than is exhausted, creates a slight internal pressure which tends to keep dust and dirt out of the building.

One of the unusual features of a new office building erected by the *SQUARE D CO.* in Milwaukee is an air conditioning system which supplies cooled and dehumidified air to the office space by way of millions of holes in metal ceiling tile. In making the entire surface of the ceiling serve as the distribution duct for air conditioning, the design is said to eliminate drafts. Water used for air conditioning also serves to cool the roof through a system of sprinklers.

LAURENCE V. TEESDALE, engineer at the *U.S. FOREST PRODUCTS LABORATORY* in Madison, Wis., left last month for Pakistan to help lay out a new forest products laboratory as a part of the Point 4 Program under the U.S. Foreign Operations Administration. The forest research center will be located in Chittagong, which is in East Pakistan near Calcutta. It will cover about 10,000 sq ft and will include a wood preserving plant, kiln drying facilities, equipment for testing physical and mechanical properties of various species, machinery for composite wood products and some equipment for wood chemistry.

ROYAL JET, INC. is the new name of Royal Heater, Inc. The company is undertaking changes in production and a reorganization of its selling program. The new sales changes will add new territories to the company's national coverage.

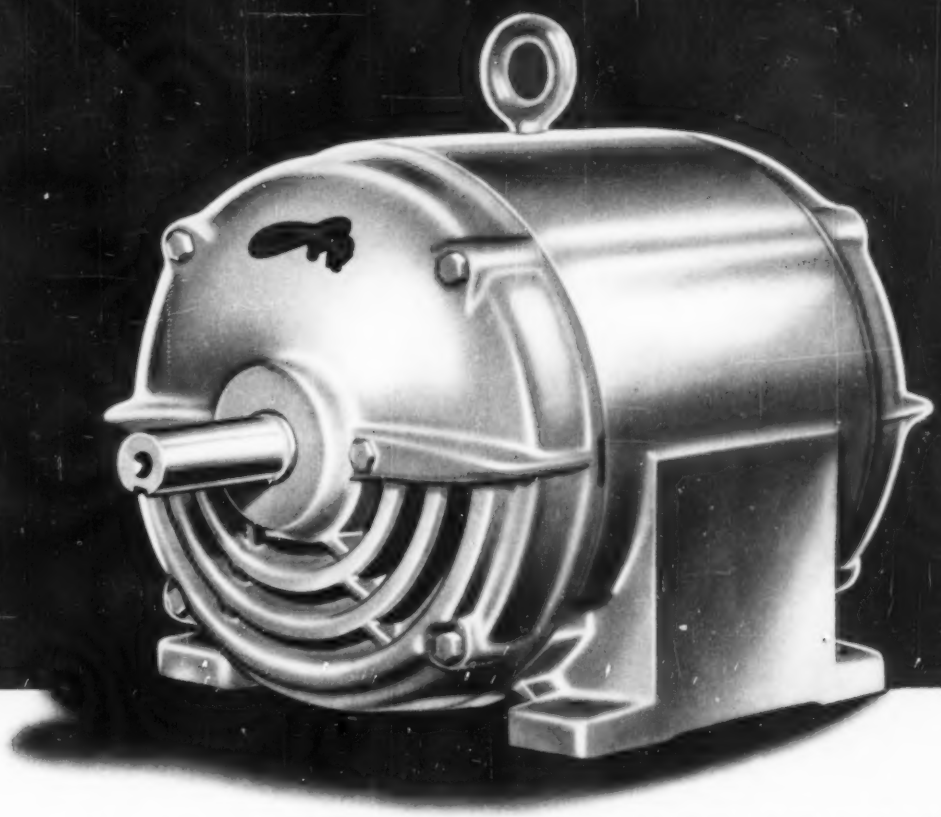
MARLO COIL CO. has begun construction on a new plant which will total 260,000 sq ft when completed, four times the company's present plant size. The first unit of 80,000 sq ft is expected to be in operation about March 1, 1954. The remaining two units are scheduled for completion within the following two years.

The entrance of *UNION ASBESTOS & RUBBER CO.* into the heating and air conditioning field has been announced. The board of directors has approved taking over the operation of the Nevinger Mfg. Co. of Greenville, Ill., a supplier of branded air conditioning units and components to other manufacturers.

GUSTAV H. KOCH, an engineer for *WESTINGHOUSE ELECTRIC CORP.,* recently received a $5000 "outstanding invention" award for devising a way to make an electric fan blow more air. Mr. Koch, who now is manager of fan engineering, discovered that if air coming into an electric fan from the side could be directed forward, the air output of the fan would be greatly increased. To achieve this, he invented a series of curved rings, called

Not just a "face-lifting" to meet the new NEMA standards,
but a completely redesigned motor line

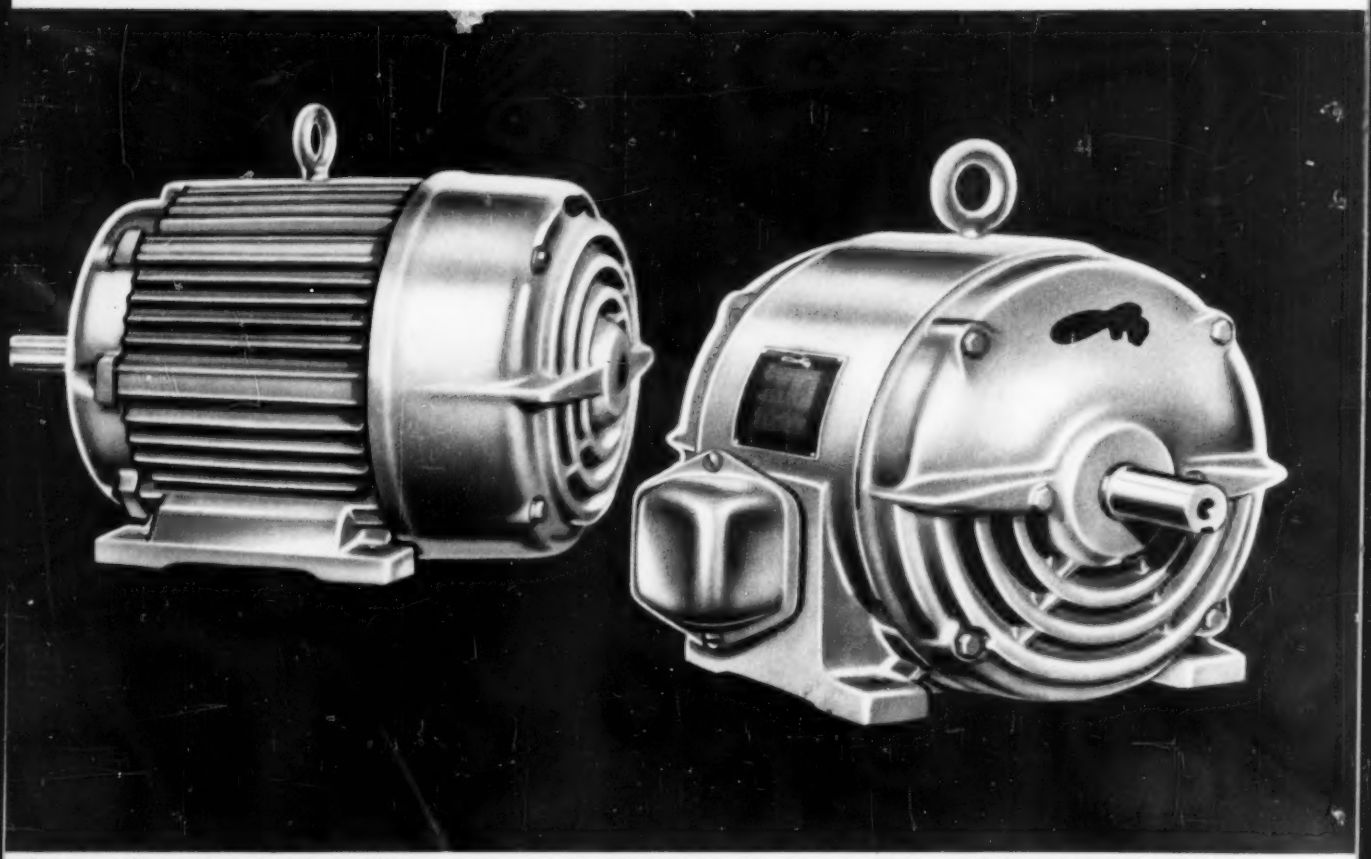
The Louis Allis Co. proudly presents the NEW L.A. *Line of electric motors*



. . . the concentrated utilization of over 50 years of engineering and development brings you this new concept in motors.

Please turn the page . . .

Here's new power for all standard and special motor applications



▲ *New L. A. Fan-cooled and Explosion-proof Motor*

▲ *New L. A. Open Drip-proof Motor*

From over 50 years of motor building experience and

many famous firsts including

the first fan-cooled, explosion-proof motor
the first rapid-reversing motor
the first really splash-proof motor
the first screenless textile motor

comes the NEW *Line*

Here's the motor that's entirely new through and through, with such features as new modern styling... improved ventilation ...greater protection... new conduit box arrangement ...new bearing construction... and more versatile mounting. Get the facts on the most up-to-date motors available—the new L.A. line. See how these new motors can provide more power in a smaller package for your product or plant ...with the same high standards of Louis Allis performance, temperature ratings, service factors and torques. Call your Louis Allis Sales Engineer for the complete story.

Special Note *Louis Allis motors, built to the same high standards of quality and performance in the old NEMA standard frame sizes, will still be available if you require them for interchangeability or replacement.*

THE LOUIS ALLIS CO. · MILWAUKEE 7, WISCONSIN

Printed in USA

WE HEAR THAT . . .

[*Continued*]

air injector rings, which surround the fan and guide air into the main air streams without turbulence. Westinghouse has applied his invention to its "Mobilaire" fan.

In a new step to create interest in its traveling show on automatic heating and cooling controls, *PENN CONTROLS, INC.* has placed "circus advance men" in the field a week before the show arrives. Decked out in circus barker's regalia, complete with derby, cane and checkered vest, the Penn advance men call on wholesaler sponsors, dealers, manufacturers and trade organizations to announce the show.

D. C. SPAHR, sales engineer for Mueller "Climatrol" and a well known authority on boilers and radiators, currently is teaching a class in "Heating and Ventilating for Small Buildings" in the evening division of the *UNIVERSITY OF WISCONSIN EXTENSION DIV.* in Milwaukee. His course is intended for men engaged in the heating and ventilating field and consists of a study of the principles and practices of heating and ventilation for residential and small commercial and industrial buildings.

TURBINE EQUIPMENT CO. has announced the formation of its Hynes Electric Heating Div., for engineering, manufacturing and sales of Hynes industrial electrical heating equipment. *LEE P. HYNES*, who developed the equipment, will be retained as electrical and mechanical consulting engineer.

A million-dollar order for self-contained air conditioning units was announced recently by *CARRIER CORP.* Believed to be the one of largest transaction covering this type of equipment, 1000 units are being purchased by *CARLETON-STUART CORP.* distributor for Carrier in New York City and Westchester County. The units range in size from 2 to 15 hp and will be installed in stores, offices and other commercial establishments.

The famous Franklin Medal, highest honor awarded by *THE FRANKLIN INSTITUTE*, this year was awarded to *WILLIAM FRANCIS GIBBS*, naval architect and marine engineer. The medal was given as a result of his efforts in the fields of naval engineering and architecture which led to the design of the S.S. United States.

SAM LAUD, president of *GENERAL AMERICAN TRANSPORTATION CORP.*, recently announced the acquisition of the business and assets of *PARKER-KALON CORP.* through the purchase of capital stock. The business will be operated as the Parker-Kalon Div. of General American. Parker-Kalon manufactures screw fastening devices. The present management is continuing its control of operations and sales.

Two new buildings have been completed for the Detroit and Greensboro, N.C., branches of the *JOHNSON SERV-*

No longer is it necessary to invest in dual fuel to utilize gas.

just *Add* gas!

. . . . . **WEBSTER'S REVOLUTIONARY PACKAGED RECTILINEAR* GAS BURNER**

The Packaged Rectilinear makes four inches pressure do the work of four pounds with fractional horsepower.

You can fire gas — automatically — through any narrow opening without disturbing your present firing equipment — hand or stoker fired coal, oil or whatever it may be.

*TRADEMARK

Write for Literature

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

WE HEAR THAT . . .

[*Continued*]

ICE CO. The Detroit building, at 840 Hilton Rd., occupies 6300 sq ft for office space, warehouse and shop facilities. Both buildings are air conditioned.

A two million dollar order for air conditioning equipment for the Chicago area has been announced by *CARRIER CORP.* The order, placed by *H. J. PREBENSEN*, president of *TEMPERATURE EQUIPMENT CO.*, is believed to be the largest single contract for unitary air conditioning ever placed.

The *AIRTEMP DIV.* of *CHRYSLER CORP.* has announced a new distribution pattern for its air conditioning and heating products. Previously, Airtemp had dealt directly with individual dealers classified according to the type of products sold. Under the new arrangement, wholesale distributors of Airtemp products will be strategically located in every important air conditioning market area. Each distributor will service a number of dealer accounts in his particular area.

The Kaustine Co., Inc., has changed its name to the *KAUSTINE FURNACE & TANK CORP.* The more descriptive name was voted because the larger portion of the firm's production is warm air furnaces and oil and gasoline storage tanks.

The *BALTIMORE AIRCOIL CO., INC.* has begun construction on a new building adjacent to its present plant. The new addition, consisting of a one-story building of brick and steel, will increase the manufacturing capacity about 60 percent. Completion is expected by the end of the year.

The *UNIVERSITY OF PITTSBURGH* has let contracts totalling more than $1 million for the construction of a building to be the new headquarters for its schools of engineering and mines. The new building will house research and laboratory space, hydraulics laboratory, strength of materials laboratory, soil laboratory and a chemical engineering laboratory. The wind tunnel for aeronautical engineering will also be housed in one section of the six-story building.

The *BURGESS-MANNING CO.*, Industrial Div., has announced reorganization of sales and advertising policies to better coordinate with the trends toward industrial noise abatement. Merchandising Advertisers, Inc. of Chicago, will coordinate and execute the new plans.

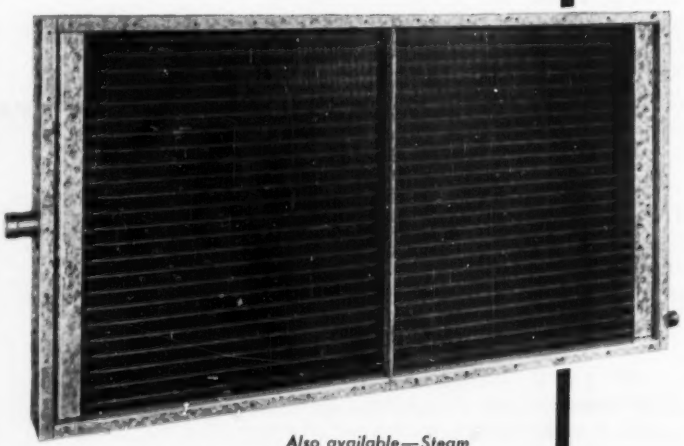
HOWARD W. BOYNTON, vice president and treasurer of *HANDY & HARMAN*, recently was honored on the occasion of his 50th anniversary with the company. At a company dinner at the Waldorf-Astoria Hotel in New York City, Mr. Boynton was presented with an inscribed gold tray.

RIGIDBILT STANDARD STEAM HEATING COILS

Maximum Heat Transfer Assured!

Complete heat transfer by heavy aluminum fins, heavy galvanized steel casings. Extruded fin collars entirely surround copper tubes. Fully enclosed headers, thus air directed over finned section only. Bolted and punched casings for easy installation. Standard steam coils variable in height and length permit coil selection to your exact needs. Entire coil custom engineered and tested to 300 lbs. air pressure under water.

RIGIDBILT IS BETTER BUILT—Write for Catalog



Also available—Steam Distributing Tube Heating Coils.

RIGIDBILT INC.

2852 W. FULTON ST., CHICAGO 12, ILLINOIS

FAST DELIVERY!

AIR CONDITIONING & VENTILATING UNITS • UNIT & PRODUCT COOLERS • HEATING & COOLING COILS
ALSO COILS DESIGNED AND BUILT FOR SPECIAL APPLICATIONS

WHO'S WHAT . . .

JOSEPH A. GRAZIER has been elected president of *AMERICAN RADIATOR & STANDARD SANITARY CORP.*, succeeding *THEODORE E. MUELLER*, who was elected chairman of the board of directors. Mr. Grazier has been serving as president since June and before that was executive vice president. He is also a director and member of the executive committee of the corporation, and has been with the firm since 1937.

H. H. SIMMONS, advertising and sales promotion manager of *CRANE CO.*, retired December 1. Mr. Simmons was appointed advertising manager in 1935. He will be succeeded by *J. D. JENTZ*, who has been assistant manager since 1952. *PAUL F. FROEB* has been named assistant manager.

WALTER R. MURRAY has been appointed sales promotion manager of the *UNITED STATES AIR CONDITIONING CORP.* Mr. Murray was formerly with Vance Pidgeon & Associates Advertising Agency in Minneapolis. Prior to that he was with the Merchandising Div. of Minneapolis-Honeywell Regulator Co.

HAROLD WEINBERGER has been named advertising manager of the *READING TUBE CORP.* Mr. Weinberger will be responsible for the company's national and direct mail advertising program, sales promotion and public relations activities.

ROY L. BRITTAIN has been elected treasurer and director of the *V. D. ANDERSON CO.* Comptroller of the company since 1948, Mr. Brittain, in addition to his new responsibilities, will continue to head the bookkeeping, cost accounting and budgeting departments.

Two major executive appointments have been announced by *AFFILIATED GAS EQUIPMENT, INC. JAMES A. HUGHES*, a vice president of the company and general manager of its *BRYANT HEATER DIV.* since 1951, has been appointed assistant general manager of Affiliated Gas in addition to his regular duties as Bryant general manager. *HOWARD L. CLARY* now is assistant general manager of Bryant. Mr. Clary most recently was vice president of the Norge Div. of Borg-Warner Corp.

DR. P. W. BAKARIAN, an expert on light metals, has been named plant manager of *CRAMET INC.*, wholly owned subsidiary of *CRANE CO.*, which is under construction at Chattanooga for the production of titanium sponge and ingots. The plant is expected to be in partial production late in 1954.

JAMES S. ANDERSON has been appointed general sales manager of the *TUBULAR PRODUCTS DIV.* of *THE BABCOCK & WILCOX CO.* Mr. Anderson, who has been with the firm since 1941, will maintain his headquarters

Speed up Assembly!

Switch to BLACK & DECKER POWER!

BLACK & DECKER HOLGUN* drills holes to ¼" diam. in steel, to ½" diam. in hardwood. Perfectly balanced, light in weight, compact, easy to handle, accurate. Famous "Pistol Grip and Trigger Switch."

BLACK & DECKER SCRUGUN* drives machine screws and nuts to ¼", self-tapping screws to #12, wood screws to #10 x 2". Positive or adjustable clutch available. Same design features as B&D HOLGUN!

SEE YOUR NEARBY B&D DISTRIBUTOR for demonstrations and full details on this famous team of assembly tools. They'll help your men turn out more work, with less fatigue and less spoilage. And you have nearly 50 other B&D Drill and Screw Driver models to choose from to fit your needs on heavier work! Write for free catalog to: THE BLACK & DECKER MFG. Co., 640 Pennsylvania Ave., Towson 4, Md.

*Trade Mark Reg. U. S. Pat. Off.

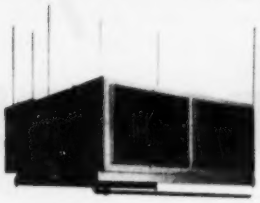
SHEARS SANDERS BENCH GRINDERS HAMMERS

LEADING DISTRIBUTORS EVERYWHERE SELL

B&D Black & Decker PORTABLE ELECTRIC TOOLS

NEW UNIT HUMIDIFIER

for Industrial Applications



BAHNSON TYPE BA-2

Here's the industrial humidifier that solves many a knotty problem. Using Bahnson's centrifugal atomization principle, it efficiently delivers up to 4000 cfm of *moist air*—no spray, no droplets—using ordinary city or well water and only 1.5 horsepower.

Self-contained unit requires only water supply, drain, electrical connection. Takes room air, saturates it, filters it, removes all excess water, and delivers the clean moist air in a controllable pattern.

ONLY BAHNSON OFFERS ALL THIS!

- **SINGLE or MULTIPLE** installation—for one room or an entire plant.
- **AUTOMATIC CONTROLS** regulate one or more units—maintain desired humidity.
- **HIGH CAPACITY**—up to 10 gph recirculating room air—up to 18 gph with heated air supply.
- **SELF-CONTAINED**—needs no pump, duct, compressed air, steam or floor space!
- **DELIVERS MOIST AIR** in controllable pattern—no droplets.
- **EASY TO INSTALL**—just uncrate and suspend from ceiling.
- **FLEXIBILITY**—can be used for heating as well as humidifying and filtering—or can be installed in existing duct system for positive humidity control.
- **TROUBLE-FREE**—no nozzles to clog—simple to operate and maintain . . . guaranteed by Bahnson, builder of the world's most complete line of industrial humidification equipment.

The BA-2 is only one of a number of units available; there's a Bahnson system suitable for any type of application; in any type of industry.

When you have a commercial or industrial humidification problem, send data for our complete recommendations.

Clip coupon to your letterhead and mail today.

☐ Send information on Type BA-2
☐ On all humidification equipment
☐ Have engineer call

Name_____

Bahnson Company
ENGINEERS AND MANUFACTURERS
WINSTON-SALEM, N. C.

WHO'S WHAT . . .

[Continued]

at Beaver Falls, Pa. where he will direct the sales of the division's carbon, alloy and stainless steel tubular products.

Another appointment announced by the division is that of *ROBERT E. HALLORAN* to the newly created position of manager of mechanical sales. Mr. Halloran joined the firm in 1941.

MAURICE E. FINE has established his office as a consulting engineer—specializing in air conditioning, heating, boiler plants and refrigeration—at 53 W. Jackson Blvd., Chicago. Mr. Fine was author of the articles in the July and December 1952 issues of HPAC on the air conditioning installation in the International Amphitheatre.

WILLIAM FEW has been appointed chief engineer at *PENN CONTROLS, INC.* Mr. Few most recently was manager of the electronic and allied products division of the Clark Controller Co. in Cleveland.

WILLIAM ORTMAN, a former group leader in the East Orange, N.J. branch office of the *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, has been named market sales manager in the company's Defense Installation Projects section. *GEORGE LANGENBERG*, who has headed the defense projects works in the Minneapolis office, has been transferred to the company's Chicago office as a group leader. Another appointment announced is that of *STANLEY L. FURBER* as sales manager of the Commercial Building Market section of the commercial division.

DWIGHT H. LORY, former assistant to the general manager of the Norwood plants of the *ALLIS-CHALMERS MFG. CO.*, has been named assistant manager of the Texrope Drive Section in Cincinnati.

C. J. HOGAN has been named assistant sales manager of *MILLER ELECTRIC MFG. CO.* Prior to this appointment he was employed by the National Cylinder Gas Co. on an assignment to Venezuela.

DOREMUS L. MILLS, development engineer, retired recently after more than 25 years with Revere Copper and Brass Inc. While in this capacity, Mr. Mills has lectured at many technical, engineering and architectural society functions and has addressed students throughout the country. He is the author of many technical articles regarding the use of Revere pipe and tube products in the field of radiant heating. Since his retirement, Mr. Mills has become associated with the *COPPER AND BRASS RESEARCH ASSOCIATION*.

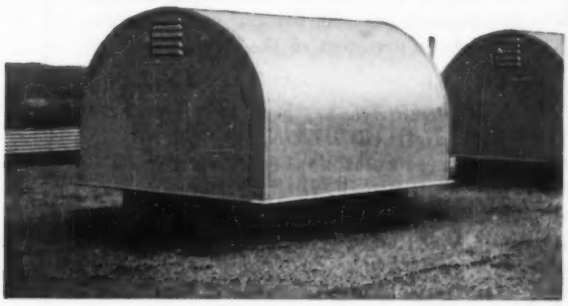
The *RELIANCE ELECTRIC and ENGINEERING CO.* has announced the elevation of two veteran company engineers, *PAUL W. ARNOLD* and *CHARLES R. SUTHERLAND*, to newly created positions at the company's head-

You **Know** what you're getting in

Airlift . . .

the completely certified

Swartwout duct exhaust ventilator



There's no guessing about actual results obtainable from the new Swartwout Airlift. The dynamically balanced heavy-duty centrifugal fan and the complete ventilator unit have been tested by an independent laboratory. The 138 capacity variations (covered by 14 ventilator sizes) have been determined in accordance with the test code adopted by NAFM and ASH & VE. Airlift is guaranteed to deliver catalogued capacities at listed static pressures.

Airlift has an unusually effective fan wheel, permitting lower tip speeds than usually possible — which means lower noise levels. Other design features reduce turbulence and increase efficiency. Power unit and fan are easily accessible in this new design. Write for Bulletin AL-F.

50 YEARS SERVICE TO INDUSTRY — 1903 • 1953

18511 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

QUESTION — A manufacturing process is powered by a 8000 K. W. turbine. For the most economical operation, water used in the process should be cooled from 105° F to 85° F, at 77° F wet bulb temperature. How much will this cooling tower cost?

ANSWER — A tower with a .78 water-air ratio is needed and will cost about $50,000.

QUESTION — How much can be saved if the tower cools from 107° F to 87° F at 77° F wet bulb temperature — 2° F higher temperature?

ANSWER — This tower will require a .95 water-air ratio, and will cost only .78/.95 x $50,000, or $41,000 a saving of $9000 in initial cost.

QUESTION — Then, isn't the second tower the better buy?

ANSWER — Before answering, let's examine your operating cost. The steam needed to operate a 8000 K. W. turbine costs about $750 per day. The 2° F overage on the second tower will increase your fuel consumption 3%, so your operating cost will be increased $22.50 per day, or $6750 per 300 day year. In ten years, your operating cost will be increased $67,500, or more than the initial cost of the first tower. The answer is definitely, No!

*When considering a new cooling tower, get the best engineering advice possible — **consult a WCEC engineer.** And after your tower is built, installed, and in operation, be sure that it meets your specifications.*

BE SURE WITH WATER COOLING EQUIPMENT COMPANY

Manufacturers of various types and sizes of mechanical draft and atmospheric cooling towers.

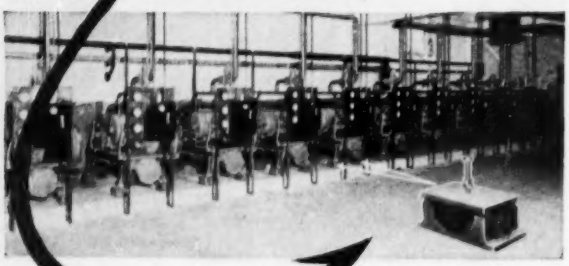
Architectural
Industrial construction
Plant engineering

water cooling
EQUIPMENT COMPANY

WCEC

Main Office: • 8601 New Hampshire Ave. • St. Louis 23, Mo.
MANUFACTURERS • ENGINEERS • CONSULTANTS
REPRESENTATIVES IN FORTY PRINCIPAL CITIES

STOP VIBRATION



with **KORFUND VIBRATION CONTROL**

Problem: When erecting a new office building, a prominent refrigeration equipment manufacturer wanted to install 41 of his units in two penthouses. Light-weight flooring with 40 foot spans between columns was planned. Vibration and noise transmission had to be prevented.

Solution: Korfund steel spring Isolators and Elasto-Rib pads completely prevented vibration and noise transmission, eliminated all bolting to the floor, and made economical light-weight floor construction possible.

In Air Conditioning, Korfund Vibration Control has paid off in dollars and cents for thousands of Engineers and Contractors, because Korfund units reduce transmitted vibration and:

- Permit installation *anywhere* in apartment, public, and industrial buildings
- Decrease original building and foundation costs
- Permit installation without reinforcing floors
- Lengthen machine life
- Permit higher operating speeds
- Reduce maintenance costs
- Insure quieter operation

We'll gladly send more information on Korfund Vibration Control for compressors, fans, pumps, boilers, air conditioners and other equipment, write today for your free copy of Bulletin #2, or see our catalog in Sweet's Files.

For specific recommendations, contact us or your local Korfund office. A half century of experience is at your disposal.

THE KORFUND CO., INC.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

48-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

WHO'S WHAT . . .

[*Continued*]

quarters in Cleveland. Mr. Arnold, formerly executive assistant to the sales vice president, becomes manager of marketing services. Mr. Sutherland, formerly manager of large motor engineering, becomes assistant chief engineer.

JOHN H. ADAMS has been named assistant chief engineer of the *DOLLINGER CORP.*, manufacturers of industrial filters. Prior to joining Dollinger he was associated with Distillation Products Industries.

WALTER J. TUOHY, president of the Chesapeake & Ohio Railway, has been elected to the board of directors of *BITUMINOUS COAL RESEARCH, INC.* Mr. Tuohy, who has been in the railroad and coal industries for 35 years, has been president of the C&O since 1948.

DON V. PETRONE has been named president of the *TYPHOON AIR CONDITIONING CO., INC.*, according to an announcement following a recent meeting of the board of directors. *J. F. DAILEY*, former president, was elected to the newly created office of chairman of the board. Mr. Petrone joined Typhoon in 1935 and since 1947 has been vice president in charge of sales. New vice president in charge of sales is *MARK E. MOONEY*, formerly vice president and sales manager of Baker Refrigeration Corp.

E. L. CASEY now is vice president in charge of operations for the *SCAIFE CO.* He was formerly associated with the Mullins Mfg. Co.

ROBERT M. GORDON has been appointed sales manager for the *TORRINGTON MFG. CO.'s* Air Impeller Div. Mr. Gordon joined Torrington as assistant sales manager in the Air Impeller Div. last February. Prior to that he had been assistant general sales manager of the Milford Rivet and Machine Co.

ROBERT P. ALLISON has been appointed manufacturing consultant to the *GENERAL ELECTRIC CO.'s* Weathertron Dept. As manufacturing consultant, Mr. Allison will be concerned with coordinating manufacturing facilities with product development. The appointment is part of the company's expansion of activity in the heat pump field. Mr. Allison, who has been with General Electric since 1935, formerly was manager of manufacturing of conduit products for the construction materials department.

HAROLD MASSEY, assistant managing director of the Gas Appliance Manufacturers Association, has been re-elected to the board of review of the *AMERICAN STANDARDS ASSOCIATION.* Other members of the board are: *VIRGIL M. GRAHAM*, Sylvania Electric Products, Inc.; *HARRY E. JORDAN*, American Water Works Assoc.; *W. P. KLIMENT*, Crane Co.; *E. B. PAXTON*, General

In modern buildings like the

BOSTON FEDERAL RESERVE BANK

correct circulation and distribution of air is a difficult problem. Of major importance is the assurance that the Multi-blade Damper units will operate smoothly and efficiently at all times. The C. P. Blouin Company, Cambridge, Mass., constructed and installed all the Dampers.

Says **Charles Blouin,** *President*

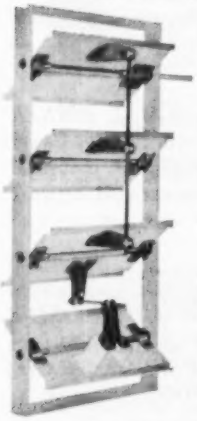
"We are assured of producing as fine a Multi-blade Damper as money can buy because we construct them with...

"DURO-BLADE-KIT"

PRECISION-ENGINEERED

DAMPER HARDWARE

Engineers & Fabricators . . . **when you specify and use the "DURO-BLADE-KIT" you will be assured maximum Damper efficiency.**



Check these Important Features:

- Produces highest quality commercial Damper known.
- Self-centering "Duro Bracket" assures smooth, non-binding operation.
- Sturdy, solid construction permits use on heaviest Dampers.
- All materials corrosion-resistant.
- Fits all blades 3 inches or wider. Parallel or Opposed Blade action.
- Easily adjusted even after being installed.
- Excellent for making Approved Fire Dampers.

Model shows how either parallel or opposed blade action is accomplished.

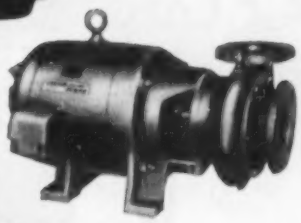
WRITE for Free Demonstration Kit and illustrated Manual on the construction of "Approved" Dampers

DURO-DYNE CORPORATION Dept. D

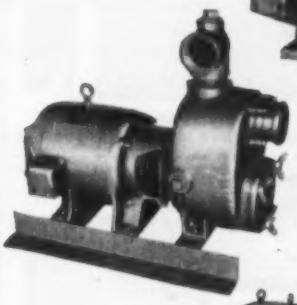
38 SOUTH FRANKLIN STREET, HEMPSTEAD, L. I., N. Y.

Got a *Pumping* problem? Let CARVER Help You Get Top Performance!

MODEL B ELECTROPUMP
5 to 70 G.P.M.



TYPE L ELECTROPUMP
30 to 900 G.P.M.



MODEL "K" PUMPS
Self-Priming
20 to 4000 G.P.M.

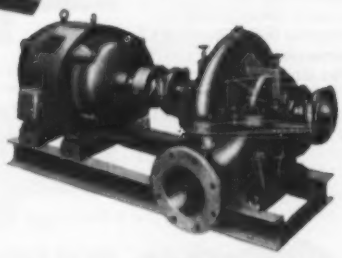


Fig. "400"
SPLIT-CASE PUMPS
200 to 2000 G.P.M.

Whatever your requirements there is a pumping unit in CARVER'S Complete Line that will fit your needs to a "T". On the easy jobs or the tough ones, the outstanding performance, inherent high efficiency and improved hydraulic design of CARVER PUMPS give you thoroughly dependable operation with full pumping economy . . . your best buy for better pumping. A few of them are illustrated.

Ask CARVER for the answer to your pumping problems . . . today. Give us the conditions, we'll give you the answer.

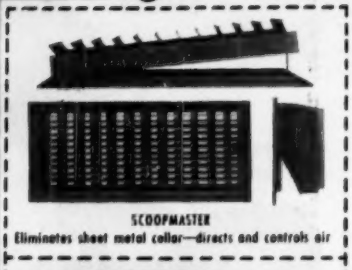
CARVER PUMPS are available with motor, gasoline engine, diesel or belt drive.

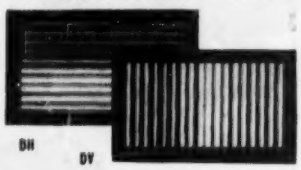
CARVER PUMP COMPANY
1460 Hershey Ave., Muscatine, Iowa

CARVER
the quality name in pumps

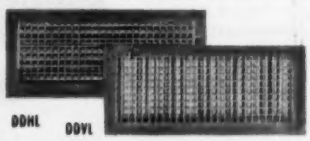
when in the dark...
Look to
Stewart
for Outstanding
New Advances in
Air Conditioning Outlets

In this Complete Catalog...
For Quality, Originality, Economy and Fast Delivery—your best choice is Stewart for Industrial and Commercial Registers—Grilles and Air Controls. You'll find one to suit your every need in the new 28 page Catalog #53.


SCOOPMASTER
Eliminates sheet metal collar—directs and controls air

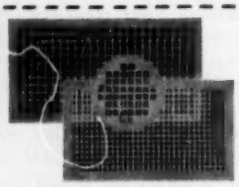


SINGLE BANK OUTLET



Triple Bank Registers Individually Adjustable Fins

Opposed-Action Valves
optional with all Supply and Return Air Registers


PLAIN LATTICE GRILLES

SCOOPTROL
Deflects and controls the air from a supply duct into a collar

Stewart MANUFACTURING CO., INC.
Grove Ave., Essex County, Cedar Grove, N. J.
2261
Representatives in the Principal Cities of United States, Canada and the West Indies.

WHO'S WHAT . . .

[*Continued*]

Electric Co.; *T. E. VELTFORT*, Copper and Brass Research Assn.

HOWARD H. FOSTER has been elected treasurer of *AIR REDUCTION CO., INC.* succeeding William Winters, Jr., who retired after 35 years of service with the company. Mr. Foster joined Air Reduction in 1933 and has served in various sales and management positions. In 1946 he was appointed manager of business relations. He was elected assistant treasurer of the corporation in February of this year.

Two additions to the heat transfer sales department of *THE TRANE CO.* have been announced. *ELLSWORTH A. BROWN, JR.*, has been appointed assistant to the manager of process heat transfer sales. New assistant to the manager of aircraft equipment heat transfer is *VERNON R. ANDERSON.*

CLIFFORD S. STEPHENS, formerly in charge of the Washington, D. C. office of *TRION, INC.*, has been appointed assistant to the president, *EDGAR W. MEYERS, JR.* Another appointment announced by Trion is that of *GEORGE M. HOFFMAN* as a project engineer. Mr. Hoffman's work will consist of processing and technical consultation on the design of equipment, particularly in connection with contracts with the Dept. of Defense.

DANIEL J. QUINN has been appointed general sales manager of the radiator heating and plumbing division of *AMERICAN RADIATOR & STANDARD SANITARY CORP.*, and *WALLACE F. HASTIE* has been named assistant manager. Mr. Quinn was formerly assistant general sales manager. He succeeds *JOSEPH SALAMONE*, who has been appointed manager, branch house operations. Mr. Hastie had been manager of the company's San Francisco sales office.

E. F. DREW & CO., INC. has named *M. E. REINER* as division manager to direct the activities of its Power Chemicals Div. Mr. Reiner, a specialist in industrial water problems, will supervise the international network of Power Chemical field offices.

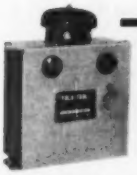
Changes in the board of directors of its Canadian subsidiary in Toronto have been announced by *THE TRANE CO. DONALD C. MINARD* and *WAYNE J. HOOD* have been elected directors to replace *REUBEN N. TRANE*, chairman of the board, and *FRANK HOOD*, treasurer.

JOHN D. SMALL, chairman of the Munitions Board, U. S. Dept. of Defense from 1950 to 1952, has been elected executive vice president and a director of *QUIET HEET MFG. CORP.*, a subsidiary of Emerson Radio and Phonograph Corp. Mr. Small, formerly vice president and ex-

SERVING THE HEATING INDUSTRY SINCE 1926

Yula

A Complete Line of Dependable Heat Exchangers

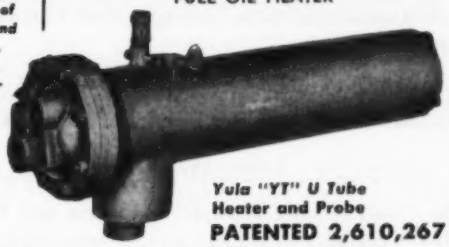


Yula-trol Relay box and alarm

Get DOUBLE* PROTECTION for your oil burner installations with . . .

Yula-trol
FUEL OIL DETECTOR
and
Yula "YT" "U" Tube
FUEL OIL HEATER

***Approved** by New York City Board of Standards and Appeals. No. 367-50-S.A.*



Yula "YT" U Tube Heater and Probe
PATENTED 2,610,267

* **Protects system from serious damage, in case of an oil leak in the Pre-heater, by shutting off oil burner, sounding an alarm, flashing on a red light.**
* **Acts as a Low Water Cut-off**

RESULT: Heating System protection at low cost

OTHER *Yula* PRODUCTS

TYPE "M" MIXING VALVE Automatically mixes hot and cold water or other fluids. Delivers it at any predetermined constant temperature.

INSTANTANEOUS HEATERS . . . Ideal for domestic and industrial applications where large volumes of hot water or other solutions are needed for service water supply or process work

CONVERTERS . . . For water in tubes, steam in shell, or water to water applications. "U" tube bundle construction simplifies cleaning.

DRY EXPANSION FREON COOLERS . . . Designed for air conditioning, refrigeration, and industrial and process uses for cooling water or other liquids.

A.S.M.E. CONSTRUCTION

The Yula Engineering Staff is at your service

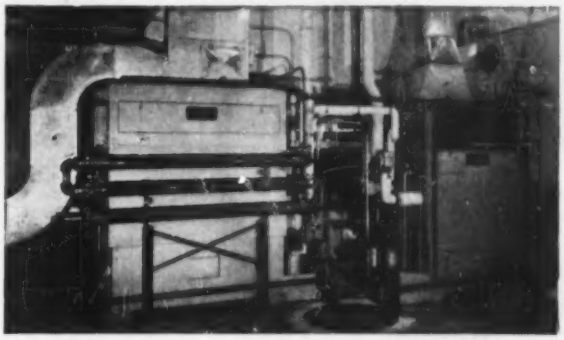
YULA WATER HEATERS, INC.

166 WEST 225th STREET, NEW YORK 63, N.Y.

MEMBER FUEL OIL AND WATER HEATER MANUFACTURERS ASSOCIATION

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

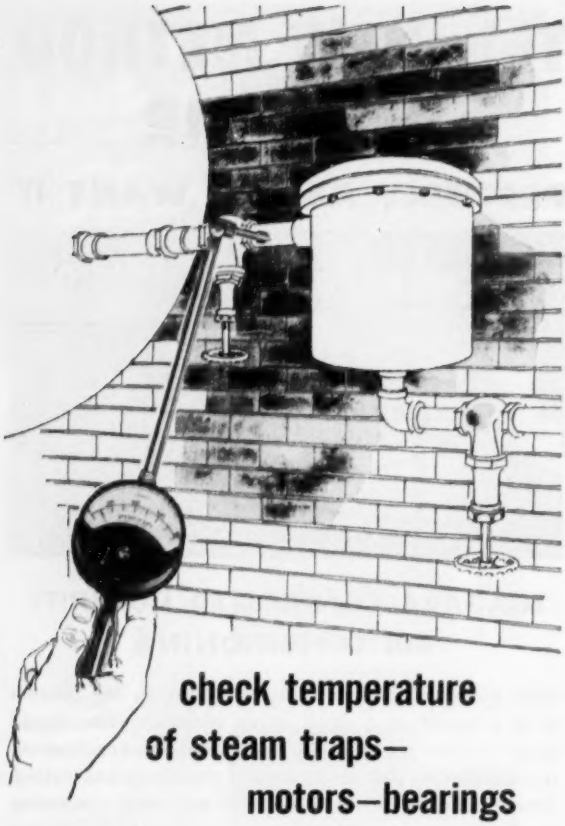
For complete information write

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HP, 405 Lexington Ave. New York 17, N. Y.

Sales Engineers in Principal Cities of U. S. and Canada



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 513, 420 N. LaSalle St., Chicago 10, Ill.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

WHO'S WHAT . . .

[*Continued*]

ecutive assistant to the president of Emerson, resigned the position in 1950 to serve as chairman of the Munitions Board. At the time he was elected vice president of Pressed Steel Car Co., Inc. He served in this capacity until his resignation to accept the Quiet Heet post.

IN THE TERRITORIES . . .

For *SERVEL INC.—L. W. WIND CORP.*, 101 S. Meramec St., Clayton, Mo., is the new air conditioning distributor for the St. Louis area. The corporation's territory includes 51 counties in the eastern half of the state of Missouri and four counties along the Mississippi River in the state of Illinois.

For *CHRYSLER CORP., AIRTEMP DIV.—E. D. DICKSON* has been named to head the division's new Florida sales region. Headquarters are at 2357 S. W. 22nd St., Canal Way, Miami. The territory includes southern Georgia and all of Florida, except the Pensacola area. Mr. Dickson has been associated with Chrysler Airtemp since 1940

New distributor for Airtemp products in northern California and northern Nevada is *TAY-HOLBROOK, INC.* Headquarters are at 165 Eighth St., San Francisco.

For *TIMKEN SILENT AUTOMATIC PRODUCTS*—New district sales manager in Indiana and Kentucky is *JOHN SAPE.*

For *A. O. SMITH CORP.—A. R. SCHNELLER* has been appointed manager of welding sales for the Pacific Coast region by the Welding Products Div. He had previously been responsible for welding sales in Wisconsin.

For *MILLER ELECTRIC MFG. CO.—HAROLD VAN PELT* is district manager for lower Michigan and northern parts of Indiana and Ohio. He had been with Linde Air Products Co.

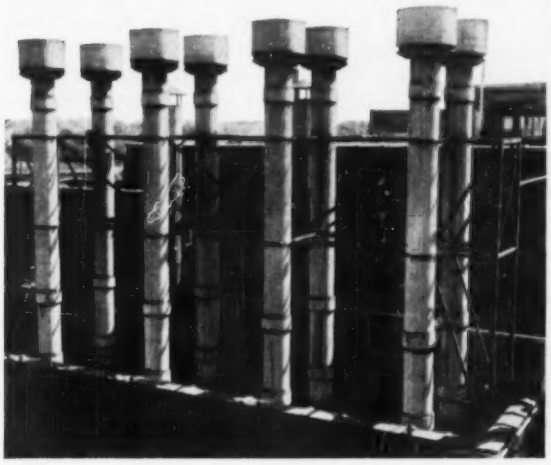
For the *DOLLINGER CORP.*—New district sales representative for the Chicago area is *GENN & LOGAN*, 3959 Lincoln Ave.

For *ALUMINUM CO. of AMERICA*—Second distributor for "Alcoa" products in the Cleveland area is the *HAMILTON STEEL CO.*, a subsidiary of Federated Steel Corp. of Pittsburgh. According to company officials, the expanding industrial development in Cleveland has made the additional facilities necessary. The other distributor, since 1929, is Williams & Co., Inc.

For *TUBE TURNS, INC.*—Several additions to the sales staff. *EARL R. MUIR, JR.*, a sales engineer, has been assigned to the Seattle office, 203 White Bldg. Another sales engineer, *RICHARD T. BURKE*, has joined the

Year after Year

In industry after industry...



TRANSITE® INDUSTRIAL VENT PIPE

defies corrosive fumes, vapors

IN INDUSTRY AFTER INDUSTRY where venting was a difficult problem, Transite Industrial Vent Pipe has demonstrated its ability to stand up under severe conditions. Instances are common of original Transite installations, *still* serving without replacement cost, after periods of over 20 years.

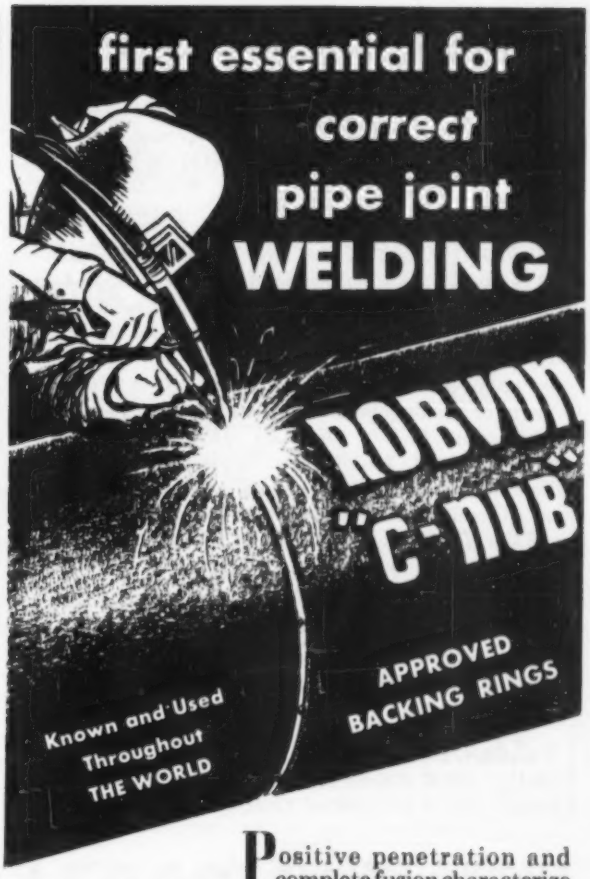
Made of asbestos and cement, Transite Industrial Vent Pipe is highly resistant to corrosive fumes, vapors, dusts and gases. And, of course, it is weather-resistant, too. Non-metallic, it needs no painting or other protective treatment.

Light in weight, easily cut and drilled with ordinary tools, Transite Industrial Vent Pipe is readily handled and erected. It is available in a wide range of diameters, offers a line of Transite fittings that make it outstanding for many kinds of venting jobs.

For further information write to Johns-Manville, Box 60, New York 16, N.Y.

Johns-Manville

TRANSITE INDUSTRIAL VENT PIPE



Positive penetration and complete fusion characterize welds made with ROBVON "C-NUB" Approved Backing Rings—the most economical "tool" a welder can use.

SAVES MORE THAN 50% fit-up preparation—SAVES materials—SAVES on maintenance and replacement costs.

100% EFFICIENCY—Time, Labor and Materials. **PERFECTS JOINTS—PERFECTION PROVED** by X-Ray, Radiograph or Gamma Ray inspection.

PROVE IT TO YOURSELF. One trial will prove to you the many reasons why ROBVON "C-NUB" Approved Backing Rings have been "Standardized" on by the best Fabricators, Weld Fitting Manufacturers, Designers, Consultants, Public Utilities, Shipbuilders, Refiners, Chemical, Textile and other large Industrial users, Boiler and Turbine manufacturers, and many others. Approved by USCG, USMC, AWS, PFI, ABS and other U. S. Government agencies.

Iron Pipe and Spiral-Weld Pipe and Tube sizes—¾" to 60". "NUB" Spacer Root Openings are ⅛", 5/16" and ¼".

TRY THEM—YOU'LL BE GLAD YOU DID.

Send for Catalog and Data Sheets.

ROBVON Industries, Inc.

675 GARDEN ST., ELIZABETH, N. J.

WHO'S WHAT . . .

[*Continued*]

Houston staff. *BERT GRANT* has been assigned to the Pittsburgh office and *CLYDE CHRONISTER* to the Tulsa office.

For *RELIANCE ELECTRIC and ENGINEERING CO.*—Establishment of a direct factory sales office in San Francisco and additions to its engineering personnel in Los Angeles and San Francisco. The new sales office will serve accounts in northern and central California. New engineering personnel includes *WALTER A. JENSEN*, formerly of the Buffalo, N. Y. sales office, who goes to San Francisco and *PERRY DUDLEY, JR.*, of the Cleveland office, who goes to Los Angeles. Replacing Mr. Jensen in Buffalo will be *PETER W. WEST*, also from the company's Cleveland headquarters. In the midwest, *JAMES D. WEBER* has joined the Detroit district sales office as a sales application engineer.

GEORGE V. ZINTEL, 840 N. Michigan Ave., Chicago, has been named sales representative for the *BALTIMORE AIRCOIL CO.* in the Chicago and central Illinois territory.

For *CENTURY ENGINEERING CORP.*— The *ARMSTRONG HEATING SUPPLY CO.*, 4500 W. Fillmore St., Chicago, now is distributing Century's line of gas and oil automatic heating equipment. Dealers in Chicago and northern Illinois will be served.

For *KENNARD CORP.*—Two new sales representatives. *REFRIGERATING and POWER SPECIALTIES CO.*, 380 Brannen, San Francisco, will cover the area consisting of northern California and western Nevada. The *NEILL EQUIPMENT CO.* of Omaha has been appointed sales representative for the corporation in Nebraska. Nebraska was formerly handled from the Kennard sales office in Kansas City, but it now has been made a separate sales territory. Neill headquarters are at 511 Keeline Bldg. in Omaha.

For *WILLIAMS DIV.* of *EUREKA WILLIAMS CORP.*—*HOLLIS L. FARROW* is the new field service engineer for the division. He will have charge of service and installation of its products in Maine, Massachusetts, Connecticut, New Hampshire and Rhode Island.

New field sales representative for northern Illinois and Indiana is *HAROLD HANSEN*. Mr. Hansen will have charge of a 29-county area in the two states.

A new stock-carrying factory warehouse and a sales office has been established at 4384 E. Bandini Blvd., Los Angeles, by *QUAKER RUBBER CORP.*, division of *H. K. PORTER CO., INC.*, to provide better service in the southern Pacific area. The new branch is under the supervision of *JAMES JOYNER*.

Darling it's so exciting . . .

I just can't wait

to see those sensational, new

STANDFORATED

Perimeter Baseboard Registers

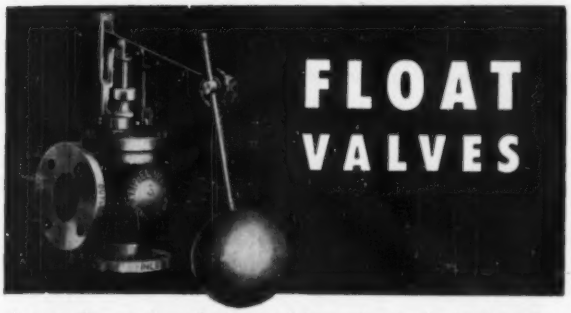
WITH SLIDING DAMPER CONTROL

Write Now for Your Free Copy of Standard's Amazing New Pocket Catalog

- Used in homes, schools, churches and commercial installations.
- Comes in four foot sections.
- Simplifies balancing of heating systems.
- Fabricated of 20 gauge steel.
- Finished with Prime Coat only—special finishes on request.

Standard Stamping & Perforating Co.

3137 WEST 49th PLACE, CHICAGO 32, ILLINOIS



FLOAT VALVES

No. 77 illustrated — Single seated float valve for dead end service. Internal pilot control. 250 lbs. max. inlet pressure. Does the job of more complicated control valves at a much lower cost wherever tight closing float valves are required for make-up water control. Sizes 2" — 8". Other types. Get BULLETIN 349.

Call Your Supply House or See Classified Phone Directories for Nearest KLIPFEL Agent.

Alabama Birmingham	Illinois Chicago	Missouri St. Louis Kansas City	Ohio Cincinnati Cleveland	Tennessee Memphis Nashville Knoxville
Arizona Phoenix	Indiana Evansville Indianapolis	Montana Billings	Oklahoma Tulsa	Utah Salt Lake City
California San Francisco Los Angeles	Louisiana New Orleans	New York Buffalo New York Syracuse	Oregon Portland	Washington Spokane Seattle
Colorado Denver	Massachusetts Boston	New Mexico Albuquerque	Pennsylvania Pittsburgh Philadelphia	Wisconsin Milwaukee
Florida Tampa	Michigan Detroit	North Carolina Greensboro	Texas Dallas	Canada Montreal
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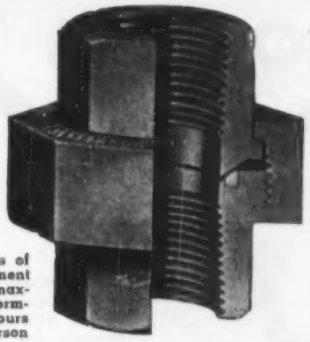
K-139

Klipfel VALVES, INC.
HAMILTON, OHIO

LOOK AT THESE FEATURES

of good design in JEFFERSON UNIONS which mean BETTER SERVICE



Better service . . in terms of easier set up, permanent leakproofness, and the maximum in economical performance . . . can be yours through the use of Jefferson Unions, because:

. . . they are made of air furnace malleable iron having a tensile strength of 55,000 p.s.i.

. . . they are air tested before shipment.

. . . they have a ball joint of true spherical contour.

. . . the seat is an exclusive Jefferson feature located in a recess of the raceway so that pipe ends cannot come in contact with it.

. . . seat rings are of drawn seamless brass tubing; they cannot rock loose because they are press-fitted into *machined* channels.

The Line is Complete

Here it is: Unions, Union Elbows and Union Tees in Jefferson 300#, Excel 250# and Master 150#; also Flanges in Jefferson 300# and Unions in Endure 300#. All lines are also available with all-iron seats. Underwriters approved.

Contact your nearest distributor or us for your requirements.

JEFFERSON UNION CO.
607 W. 26TH ST., NEW YORK 1, N.Y.
65 Gooding St., Lockport, N.Y. — 35 Fletcher Ave., Lexington 73, Mass.

MASSACHUSETTS
Power Fixed and Squirrel Cage FANS

POWER FIXED FANS

Backward curve blade type with non-overloading characteristics. Housings constructed of steel plate and reinforced with heavy bracing angles. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia. Class I or Class II construction for better fan selection.

SQUIRREL CAGE FANS

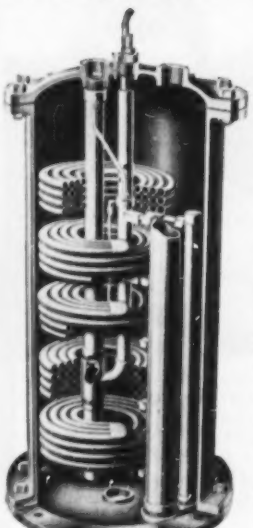
Fan wheels have low speed characteristics. The low air velocities permitted are conducive to efficient operation. Housings are rugged and compact. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia.

Housing shown above for 86½" wheel

Write for catalogs.

MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
4901 HAMILTON AVENUE — CLEVELAND 14, OHIO

AERCO COMPACT STORAGE WATER HEATER



Takes the place of large storage tanks under most conditions.

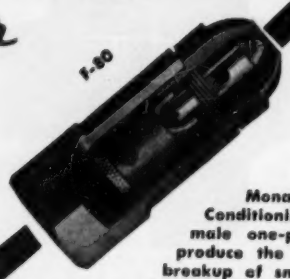
An abundant supply of hot water at even temperature under varying load conditions with low steam consumption and no surging of steamflow. The design allows the regulator to sense changes in quantity of incoming cold water BEFORE the water actually passes over the heating surfaces, thereby ANTICIPATING the new requirements of steam flow.

Write, wire or phone as to how you can effect substantial savings in cost.

- ***Minimum storage volume for peak demands.***
- ***Minimum steam input for required load.***
- ***Accurate controlled outlet water temperature under all load conditions.***

AERCO CORPORATION
214 LAFAYETTE PLACE Box 428 ENGLEWOOD, NEW JERSEY

Monarch
NOZZLES
for
HUMIDI-
FYING



Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG 6-A

MONARCH MANUFACTURING WORKS, INC.

2523 E. ONTARIO ST. PHILA. 34, PENNA

CANADIAN SALES AGENT (EXCEPT B.C.) CANADIAN GENERAL FILTERS LTD., 2679 DANFORTH AVE., TORONTO 13.

Profitable Performers!

Western Rotary Ventilators...

offer maximum exhaust capacities, superior balance design, and lifetime guaranteed bearings.

Check Sweet's or A.E.C. for complete data. Wholesalers coast-to-coast handle the Western line of rotary, stationary, continuous ridge, directional ventilators and exhaust fans. Order from your local jobber. For further information write:

Merry Anders
turns in a profitable performance in
"How to Marry a Millionaire"
in CINEMASCOPE
a 20th-Century Fox production
Color by Technicolor

WESTERN ENGINEERING & MFG. CO.
4114 Ocean Park Avenue • Venice, California

NEW BOOKS & REPORTS...

Safety Code for Mechanical Refrigeration

The *Safety Code for Mechanical Refrigeration* is sponsored by the American Society of Refrigerating Engineers under the rules and regulations of the American Standards Association Inc. The application of this code is intended to insure the safe design, construction, installation, operation and inspection of every refrigerating system employing a fluid which is vaporized and is normally liquefied in its refrigerating cycle.

Some of the various sections deal with building occupancy classification, refrigerating system classification by type, refrigerant classification, requirements for institutional, public assembly, residential and commercial occupancies, installation requirements, design and construction of equipment, refrigerant piping, valves, fittings and related parts, relief devices, and field tests.

Copies of the code may be obtained from the American Society of Refrigerating Engineers, 40 W. 40th St., New York 18, at $1.00 a copy.

Laboratory Tests of Soil Corrosion

A recent study by the National Bureau of Standards, *Laboratory Measurement of Corrosion of Ferrous Metals in Soils*, has shown that reliable data on corrosion of ferrous metals in soils of various types can be obtained in the laboratory in a period of six months. In the NBS investigation, which was conducted by W. J. Schwerdtfeger of the Bureau's corrosion laboratory, corrosion was produced in small laboratory cells by differential aeration of metal disks in contact with soil within the cells. The results for 15 different soils showed good correlation with the corrosion observed on wrought specimens in long-term exposure tests. It was found that the corrosion cell could detect significant differences between the corrosion rates of cast iron and steel, which are generally considered to corrode at about the same rate in soils. The report also stated that it is expected that the laboratory corrosion cells could be used to predict the corrosion of nonferrous metals.

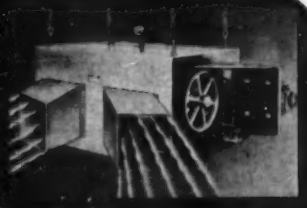
The study has been published by the National Bureau of Standards, Technical Reports Section, Washington 25, D.C.

Selection of Atmosphere Gases

Protective Atmospheres has been written especially for plant and process engineers as an aid in the selection of the best atmosphere gas for a given job. It provides a survey of the properties, applications, generation methods, and results of atmosphere gases. More specifically, there are discussions of basic chemical reactions of gases used for furnace atmospheres, atmospheres for preventing or reducing oxides, atmospheres for preventing decarburization, atmospheres for carburizing, carbon restoration and nitriding, and instruments for analyzing, controlling and measuring gases. In one chapter, tests have ben included for determining the types and sources of trouble, and the effects of gases on heating unit materials, refractories, thermocouples, personnel and metals.

The authors, A. F. Hotchkiss and H. M. Webber, have worked together for the past 24 years in the Industrial Heating Dept. of the General Electric Co. in Schenectady.

HERE'S YOUR ANSWER TO LARGE AREA SPACE HEATING!



CHROMALOX
Blower Type
UNIT HEATERS

FOR HEAVY-DUTY HEATING IN FACTORIES, WAREHOUSES, OFFICES

Ceiling mounted CHROMALOX Electric Blower-Type Heaters are your quick, easy answer to space heating! Twin centrifugal fans, driven by a 3-phase motor, distribute warmth evenly over large areas. Air ducts can be used to convey heated air to desired locations. Automatic thermal cutout assures protection against overheating. 51,180 to 136,480 BTU output per hour.

HAVE A HEATING PROBLEM OF ANY KIND?

Then write for Catalog 50. It's loaded with information on many of the 15,000 types, sizes and ratings of Chromalox Heating Units and Equipment.

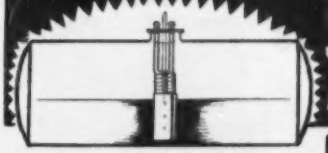
Edwin L. Wiegand Co.,
7610 Thomas Boulevard Pittsburgh 8, Pa.

CHROMALOX IB-8

ELECTRIC HEAT FOR MODERN INDUSTRY

PREHEAT HEAVY OILS IN STORAGE TANKS

REMPE "Hot Spot" PREHEATER



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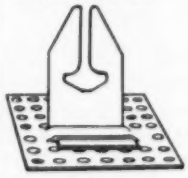
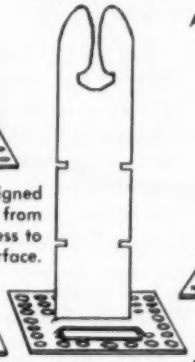
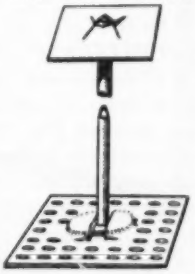


TYPE B STIC-KLIP



TYPE N STIC-KLIP AND SPEED WASHER



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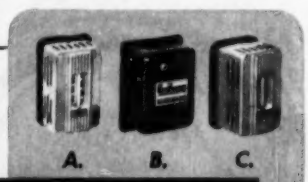

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The 341-page book is priced at $7.00 and is published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16.

Air Conditioning Conference

Proceedings of the Technical Conference on Year-Round Residential Air Conditioning, held last April at Lehigh University, has been published by the department of mechanical engineering. Professor James V. D. Eppes, conference director, edited the volume.

The book includes the technical papers presented during the two-day conference. Among the topics covered are: technical aspect of modern residential construction; a review of the ASHVE's research program; load calculations for residences, problems of control and operation of air conditioning systems; and a review of the research work done at the University of Illinois.

Copies of the volume may be secured from the Department of Mechanical Engineering, Lehigh University, Bethlehem, Pa.

OTHER BOOKS & REPORTS . . .

THE ATOMIZATION OF LIQUID FUELS—a survey of the characteristics, properties and most useful results of the atomization of liquid fuels. Discussed are the mechanism of disintegration of liquid jets, fuel spray characteristics, simple theory of the swirl atomizer, and the use of dimensional analysis for correlation of atomization data. Authors are E. Giffen, professor of civil and mechanical engineering at Queen Mary College, University of London, and A. Muraszew, also of London, who has conducted individual research.

The book contains 246 pages. It is priced at $6.00 a copy and may be obtained from John Wiley & Sons, Inc., 440 Fourth Ave., New York 16.

VISCOSITIES OF NATURAL GAS COMPONENTS AND MIXTURES—results of the experimental determination of the absolute viscosity of methane and three natural gas mixtures at pressures up to 10,000 psi, and temperatures from 70 F to 250 F. The data is presented as viscosity-pressure isotherms showing the effects of temperature, pressure and composition on viscosity. It is correlated in the form of reduced viscosity and viscosity ratio charts.

Priced at $5.00, it is available from the Institute of Gas Technology, 17 W. 34th St., Chicago 16.

SYMPOSIUM on STRENGTH and DUCTILITY of METALS at ELEVATED TEMPERATURES—With Particular Reference to Effects of Notches and Metallurgical Changes. The papers and discussion in this Symposium, sponsored by the Joint ASTM-ASME Committee on Effect of Temperature on the Properties of Metals, were presented at the 1952 annual meeting of the American Society for Testing Materials.

Copies of the 256-page Symposium are available at $3.25 each from the American Society for Testing Materials, 1916 Race St., Philadelphia 3.

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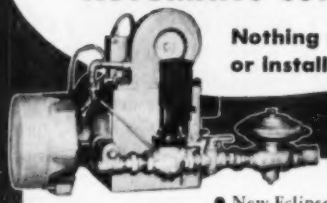

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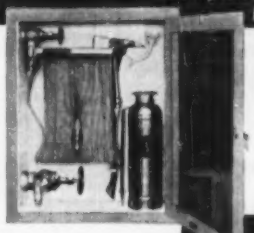

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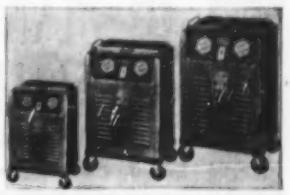

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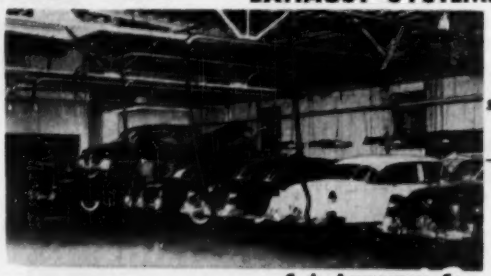

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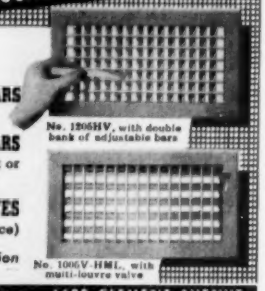

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MEETINGS & CONVENTIONS...

NATIONAL CONSTRUCTORS ASSOCIATION, 50 E. 41st St., New York—annual meeting, January 12-14, Hotel Commodore, New York. The association is composed of firms engaged in the design and construction of chemical plants, steel mills and petroleum refineries.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — Annual Meeting, January 24-27, 1954, Rice Hotel, Houston, Texas. See pages 132-134 for further details.

The Society has announced that the 1954 Semi-Annual Meeting will be held June 28-30 at the New Ocean House, Swampscott, Mass.

PLANT MAINTENANCE & ENGINEERING CONFERENCE AND SHOW—fifth annual meeting, January 25-27, 1954, Chicago. The conference will be held at the Hotel Conrad Hilton and the show will be at the International Amphitheater. Industries to get special attention include sheet metal, power and mechanical service equipment. The meeting will be divided into three general sessions, 16 sectional conferences and 40 round table discussions. One of the sectional conferences will deal with "Corrosion Control and Prevention."

Further information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2—Tenth Annual Conference and Exhibition, March 15-19, 1954, Kansas City, Mo. Co-chairmen are F. L. Whitney, Jr., Monsanto Chemical Co., St. Louis and H. L. Bilhartz, the Atlantic Refining Co., Dallas.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18—1954 National Spring Technical Meeting, May 4-7, Hotel Statler, Buffalo, N.Y. The 1954 Welding and Allied Industry Exposition will be held at the Buffalo Memorial Auditorium, May 5-8.

OIL HEAT INSTITUTE OF AMERICA, INC., 500 Fifth Ave., New York 36—32nd annual convention, May 16-20, to be held concurrently with the 1954 National Indoor Comfort Exposition. Both events will be held at the Commercial Museum, Philadelphia.

HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOC., 1250 Avenue of the Americas, New York 20—65th annual convention, May 24-28, 1954, Hotel Traymore, Atlantic City, N.J.

WESTERN PLANT MAINTENANCE SHOW, 759 Monadnock Bldg., San Francisco 5—West's first plant maintenance show, July 13-15, 1954, Pan Pacific Auditorium, Los Angeles. Produced by Clapp & Poliak, Inc., the show will emphasize the specialized problems of maintenance and engineering faced by western industry which has undergone tremendous expansion since World War II.

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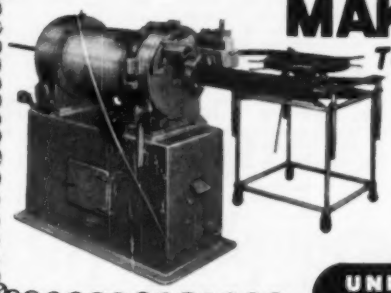

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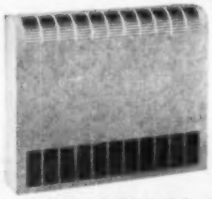

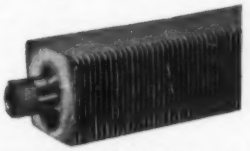

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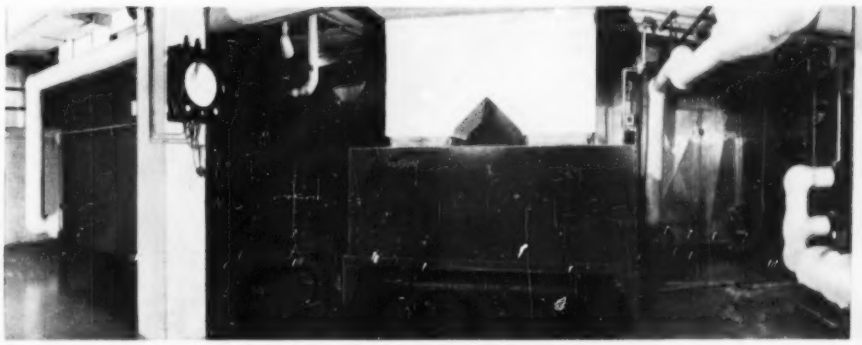

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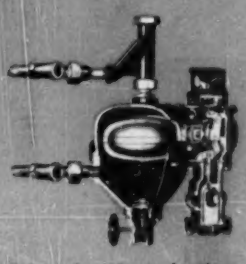

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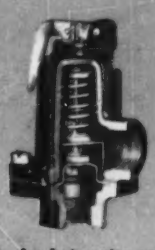

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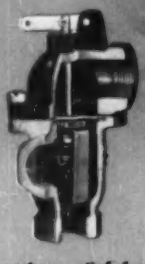

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